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A COMPENDIUM

OF

PHOTOGRAPHY,

CONTAINING CONCISE DIRECTIONS FOR

PHOTOGRAPHIC PORTRAITURE.

EDITED BY
FREDERICK J. COX.

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ELEVENTH EDITION.

LONDON:
FREDERICK J. COX,
Optician, and Manufacturer of Scientific Instruments,
26 LUDGATE HILL, E.C.
1873.

A COMPANION

OF

PHOTOGRAPHY

CONTAINING COMPLETE DIRECTIONS FOR

PHOTOGRAPHIC PORTRAITURE

EDITED BY

FREDERICK J. COX

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PREFACE TO THE TENTH EDITION.

THIS Edition has been carefully revised, and wherever possible the explanations have been simplified, so as to make it as thoroughly practical as possible. The most approved working of the present day has been substituted for those formulæ that have become obsolete; and enlargements being more in demand, a special chapter has been devoted to that subject.

It may be regarded as a useful assistant to the Professional Photographer, and a straightforward understandable Guide to the Amateur; simply and clearly written, and plainly describing the various processes without useless repetition.

It is a source of gratification to me that over 20,000 copies have been sold during the last ten years, and although the continued increase in size of each successive edition involves a considerable outlay, I have not thought it expedient to advance the price beyond the modest sum of sixpence.

I gladly avail myself of the opportunity of again thanking my friends for their kind recommendations, and to solicit a favourable examination of the Catalogue appended to this treatise, and assure them that their commands will receive my best attention.

FREDERICK J. COX.

PREFACE TO THE ELEVENTH EDITION.

THE continued increasing sale of this Handbook satisfactorily proves the want of a simple unencumbered Manual on one of the most interesting of modern discoveries.

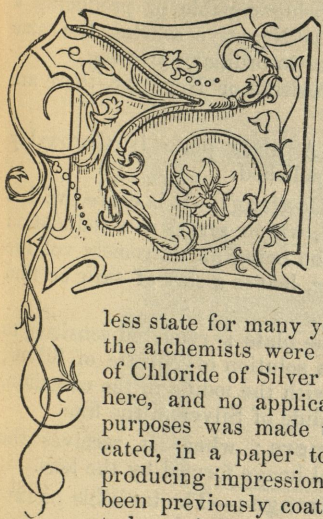
The present Edition has been entirely reprinted, and I trust will receive the same recognition of popular favour as its predecessors have done.

F. J. C.

LUDGATE HILL,

February 1873.

INTRODUCTION.



THE phenomena comprehended under the title PHOTOGRAPHY depends upon light as the force or cause, and upon the property which certain substances possess—such as the salts of silver, the salts of gold and iron, besides many other organic matters—of being decomposed or affected according to the intensity of the light. Although of modern application, the art of Photography has existed in a crude or use-

less state for many years. We find in the 16th century that the alchemists were acquainted with the blackening effects of Chloride of Silver; their researches, however, terminated here, and no application of this property to Photographic purposes was made until 1803, when Wedgwood communicated, in a paper to the Royal Institution, a method of producing impressions on paper or white leather which had been previously coated with Nitrate of Silver. The objects to be copied, such as leaves of trees, wings of insects, &c., were laid on prepared paper and exposed to the action of light; the minute fibres were then found, on removing the object, remarkably distinct. The progress of the art remained at this point for some years, the difficulty being to fix the image, or rather to prevent the paper from becoming entirely black.

All pictures produced by the agency of light may be called Photographs, whether taken on glass, paper, metal plates, or other material; and are divided into two classes, NEGATIVES and POSITIVES. A Negative being a picture with the lights and shades of the object reversed, while Positives represent the lights and shades correctly as in nature.

In describing the principles of Photography, it will be convenient to first state the general outlines of the process, and if the student will endeavour to make himself acquainted with them as a preparatory study, the manipulation described in a future chapter will be more readily understood.

There are at the present time two processes employed for Portraiture; viz. the POSITIVE and the NEGATIVE Collodion processes. They are similar in almost every respect, the preparation and composition of the chemical solutions constituting their principal distinction.

The Positive process is for taking pictures on glass, which are complete and finished in themselves.

The Negative process is followed when the intention is to produce paper copies, as photographs on paper are not procured by one operation in the Camera; but a Negative is taken on glass, from which the copies are obtained by Photographic Printing. It is this property which gives value to the Negative, it being capable of producing a large number of paper proofs; the Glass Negative serving the same purpose that an engraved copperplate does in ordinary printing.

In taking Portraits on glass, either Positive or Negative, there are seven distinct operations, viz.:—

First—**Cleansing the Glass**:—A glass plate is thoroughly cleaned and the surface polished.

Second—**Giving it a Collodion Coating**:—It is coated with a solution called Collodion, which serves as a foundation for the picture; Collodion being an extremely volatile fluid, which, evaporating, leaves a sort of skin or film on the glass.

Third—**Exciting the Plate**:—The plate is rendered sensitive to light by immersion in a solution of Nitrate of Silver, which, by combination with the iodide in the collodion, deposits a coating of Iodide of Silver in the film.

Fourth—**Exposure in the Camera**: where it receives the impression of the optical image formed by the lens.

Fifth—**Developing the latent Image**:—The invisible picture formed on the sensitive plate is developed, or rendered apparent, by the application of a solution called the Developer: this precipitates a white deposit on those portions of the plate where the light has acted, but leaves the shadows free and clear.

Sixth—**Fixing the Picture**:—The Developer having completed its work, must be removed by washing, and the picture then fixed by dissolving the curtain or screen of Iodide of Silver; it is then again washed with water and dried.

Seventh—**Varnishing**:—Practically speaking, the whole manipulation is finished at the sixth stage, but the picture requires varnishing as a protection from injury ere it can be considered completed.

Photographic Printing is effected by laying the negative face upwards upon a sheet of prepared paper and exposing to light. The clear parts of the negative allow the light to pass and darken the paper beneath, whilst the opaque portions of the negative stop the light and leave the paper white. It will be seen that the number of operations are but few, and in their practice but slight difficulty will be experienced if ordinary intelligence and care are exercised.

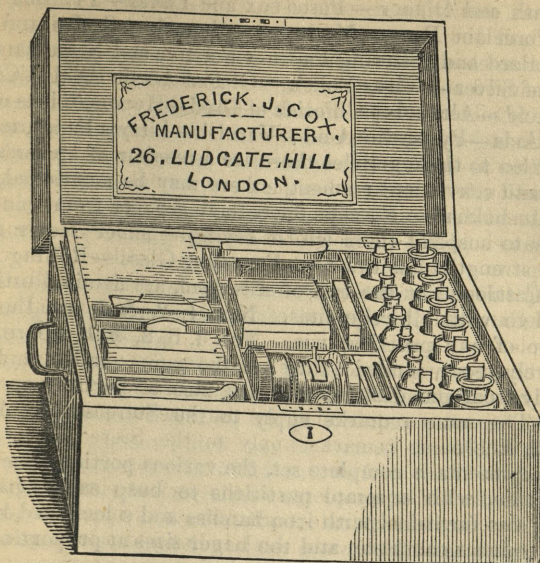


Fig. 1.

APPARATUS.

THE first thought of an intending Photographer is to procure suitable apparatus. If unfortunate in his selection he has a constant annoyance. Errors of judgment in the manipulation, or mistakes in mixing the chemicals, can be easily remedied, but an imperfect camera, or inferior lens, remains a perpetual grievance. As the price of useful and genuine instruments is materially reduced, it brings within the easy acquirement of most people apparatus in which confidence can be placed, and prevents that disappointment which naturally arises when a long price has been paid for articles that were originally made by itinerant workmen for the purpose of pawning, or being sold in disguise as second-hand. If an intending purchaser has not had experience to make him competent in relying on his own judgment, it is better to give a description of the purposes for which the apparatus is required, and throw the responsibility of the selection on the experience of a respectable manufacturer.

A Professional Photographer, and those Amateurs who aspire to competition with them, require a number of appliances that are not really essential to a beginner, but the following list contains those

articles that cannot be dispensed with:—Camera and Lens—Camera Stand—Bath and Dipper—Plate-box and Plates—Printing Frame—Glass or Porcelain Pans—Measures—Funnels—Scales and Weights—Albumenized and Filtering Paper—Positive and Negative Collodion—Nitrate of Silver—Glass Polish—Glacial Acetic Acid—Citric Acid—Nitric Acid—Alcohol—Chloride of Gold—Hypo-sulphite of Soda—Acetate of Soda—Pyrogallic Acid—Varnish—Litmus Paper, and Kaolin.

In addition to these articles there are a number of appendages, that are useful and convenient; among others may be mentioned, —Head-rests—Plate-holders—Forceps for removing paper from solutions, and Glass Clips to suspend them whilst drying—Silver Meter for ascertaining the strength of solutions—Focussing Glass—Rolling Press, &c.

In the Catalogue at the end of this book are detailed estimates for sets, complete with all requisites. Nos. 1, 2, & 3, are the cheapest that can be of any practical use. Nos. 4, 6, 8, & 9, are really good, and positively recommended: they are the same quality, and differ in price simply from the difference in the size of portrait or view they produce. The same remarks apply to the Stereoscopic Apparatus, Nos. 11, 12, & 13.

Fig. 1 represents a complete set, the various portions packed into a well-made case, with separate partitions to keep each article in its place: it is also furnished with iron handles and a lock and key, and is sold at five guineas complete, and the larger sizes at proportionate rates.

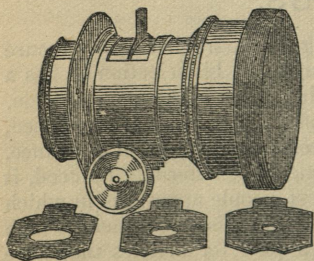


Fig. 2.

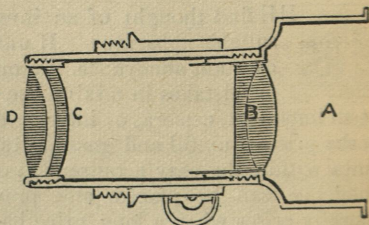


Fig. 3.

LENSES.

The selection of a Lens is determined by the character of the work it is intended to embrace, the same article not being available for all purposes or for all sizes of picture. In the early days of Photography the ordinary construction of the Camera Lens was a *meniscus*—these will do for simple copying of figures, but as the chemical and optical foci do not coincide, an allowance must be made after the Image has been

adjusted on the ground-glass of the Camera—a difficulty which is overcome by using an *Achromatic* combination of glasses.

The **Single Achromatic** is chiefly employed for landscape purposes or copying inanimate objects; it is formed of two lenses, one being double convex, the other plano-concave, and are cemented together with a transparent cement. For general Landscape work these lenses are superior to the compound lens, inasmuch as there are but two reflecting surfaces, and therefore the picture is more brilliant.

Double Combination Lenses, consisting of a set of four glasses mounted in a brass tube, are preferred for PORTRAITURE, or any purpose where the subject is likely to move; they possess great rapidity of action, and when good, give very sharp and clear definition.

If the glasses are removed from their cells in order to be cleaned, it is of the greatest importance that they should be replaced in their proper relative positions.

The construction of a Portrait Lens will be understood from *fig. 3*. A represents the hood or front of the brass work; B, a combination of two glasses cemented together, which we will call the *front lenses*; C and D, the two glasses which may be termed the *back lenses*, and are placed at the end of the tube which screws into the Camera.

When in position for portraiture, the lens B must be fixed in its mounting with the convex surface outside, or next the sitter. The two back lenses are easily recognised, as they are of different shapes, one being *double convex*, that is, thick in the centre and thin at the edge; the other is *meniscus*, or hollow, like a watch-glass. If they have been removed from their cells, first replace the double convex, flattest side downwards; over this the meniscus, with its concave side down, or next to the convex: the two glasses being separated or prevented from touching each other by means of a brass ring.

When used for distant objects or views they require a special adaptation, which can be done at a slight additional cost. A lens that has been made to adapt for both purposes will have the glasses in the same position for taking portraits as previously described; but to make it suitable for views you remove the back lenses, C and D (*fig. 3*), as they are not required, then screw the brass mounting back into the flange fixed on the Camera: having done this, unscrew the large brass hood and reverse the front lenses in their mounting, so as to place the flattest side of the glass outside or next the view: replace the brass hood, insert into it a stop or diaphragm, and proceed to work in the usual manner.

If the additional expense is not objected to a more efficient plan is to remove the front lenses, B (*fig. 3*), and screw them into a separate and distinct mounting: by this means the chance of reflection from the long tube is avoided.

The best instruments are made with a series of stops or diaphragms to fix in the centre of the combination, nearly midway between the lenses B and C ; they have apertures of various sizes, according to the effect which it is desirable to produce. For ordinary portraiture in a good light, the second size is most useful ; but when the light is feeble, or it is necessary to obtain a picture with greater rapidity than usual the plate with the largest aperture may be employed. The smaller sizes are useful in copying or in taking groups in the open air, where the sitters are placed in different planes or distances.

The arrangement adopted by Frederick J. Cox, in the manufacture of his best lenses, is to cut a slot through the brass tube, into which metal plates, with the necessary aperture, can be dropped ; by this plan the inconvenience and risk of unscrewing the lenses is avoided : *fig. 2* gives a good idea of the simplicity of this arrangement.

The Portrait Lens is only intended to be used for subjects which must be taken quickly. It does not give so flat a field as the View Lens, nor does it include so wide an angle, nor can objects at different distances be brought into good focus ; in fact, all are sacrificed for rapidity : but by introducing a small stop* between the lenses it can be made to embrace both purposes, although for landscape the Single Achromatic is recommended.

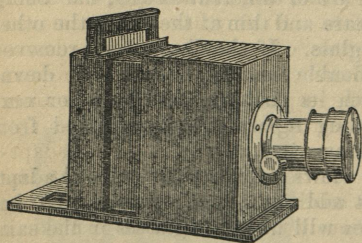


Fig. 4.

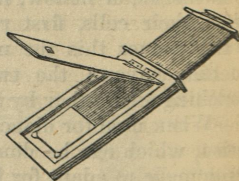


Fig. 5.

CAMERAS, &c.

A convenient form of Camera for general purposes is shown by *fig. 4*. It consists of two portions or boxes sliding within the other, the lens being fixed on the front. At the back of the Camera is a groove into which a frame slides, holding a piece of finely-ground glass, called a focussing screen: its use will presently be more particularly described. It may here suffice to say that its purpose is to receive the image formed by the lens,

* See separate article in a future chapter on the use of stops and distortion of the image.

and enable the operator to determine its correct focus. The prepared plate is placed in a small frame or box, termed a dark slide (*fig. 5* preceding page), provided with a sliding shutter in front, and a hinged door at the back: on opening the door a rabbet or ledge will be seen, on which the prepared plate is laid. The dark slide fits the posterior of the camera in the same groove as the focus screen.

Many other forms of Camera are designed for special work, or portability in travelling; for further information on this point it will only be necessary to consult the catalogue of a manufacturer of apparatus.* An ordinary tripod stand is sufficient for occasional use, or when portability is desirable; but in other cases I recommend the rigid stands, a cheap form of which we manufacture at 10s. 6d.

A Plate-holder (*fig. 6*), for holding the glass plate whilst being cleaned, is convenient, as it avoids the necessity of touching the glass with the fingers; and for large glasses, the Pneumatic Holder is required to sustain the plate while applying the collodion coating. *Fig. 7* is the best description, the vacuum being caused by raising the circular piece of India-rubber, by means of a brass pin working on a lever.

The silver solution for exciting the collodion film is contained in a vertical vessel, made of ebonite, porcelain, or glass, called a bath. *Fig. 8*.

When wanted for travelling, the water-tight top (*fig. 9*) saves the trouble of carrying an extra bottle for the solutions, and likewise diminishes the risk of spoiling the silver bath by foreign matter coming into contact whilst decanting into bottles.

Glass Baths are very much employed, and the best method of mounting them is shown by *fig. 10*, where the bath is enclosed in a wooden box provided with a cover to protect the solution from dust.

Impure gutta percha, or badly glazed porcelain, may injure the bath solution and render it unfit for use: if, however, they are pure and good, there is no fear of any injurious consequences.

Ebonite, is a preparation of India-rubber,

* See Frederick J. Cox's Catalogue at the end of this book.

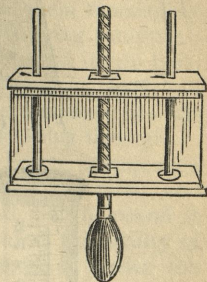


Fig. 6.

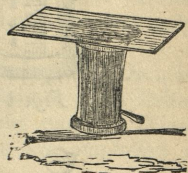


Fig. 7.

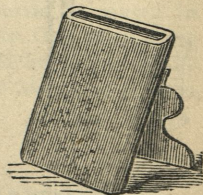


Fig. 8.

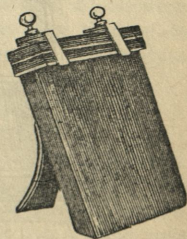


Fig. 9.

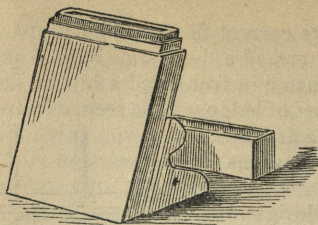


Fig. 10.

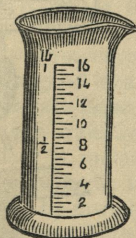
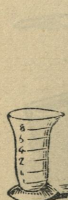
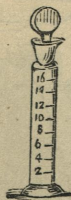


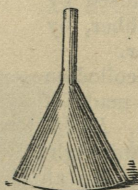
Fig. 11.



12.



13.



14.

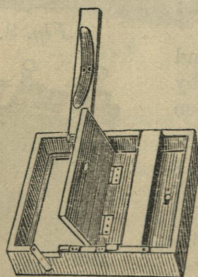


Fig. 15.

perfectly hard and impervious to acids, it is very serviceable, extremely light, and possesses all the elements of portability.

Three or four Glass Measures (*figs. 11 and 12*) will be useful to measure the proportions of solutions which are estimated by fluid measure. They are likewise extremely handy for holding small quantities of the Developing Solution, &c., as it can be poured more readily over the plate by this means than from the mouth of a bottle.

The divisions on the side of the measures denote fluid drachms and ounces, eight drachms being equal to an ounce, and twenty ounces one pint. When preparing the chemical solutions hereafter described, it is necessary to be furnished with scales and weights, and it is almost unnecessary to say that the most scrupulous care must be taken to have the pans clean and free from contamination of any kind. If the pans are made of brass, a small square of paper should be previously placed in them, to prevent contact with the metal, and a similar piece in the opposite scale as a counterpoise.

The denomination and value of the weights are stamped upon them, and agree with the chemical proportions given in the formula, according to apothecaries' weight, a table of which will be found on the last page of this book; but chemicals are always bought and sold by avoirdupois, and not by the apothecaries' weight, hence an ounce of nitrate of silver only contains $437\frac{1}{2}$ grains, and not eight drachms, as many suppose it should do.

Fig. 13 is a Collodion Bottle, or pourer. Collodion being a preparation that is constantly forming a sediment,

the bottle is designed to prevent its being disturbed every time it is used: for the convenience of mixing the collodion and iodizing solution some are graduated, like the measures, into drachms and ounces.

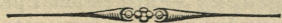
Funnels (*fig. 14*) are made in glass or gutta percha; several should be at hand, or great care must be exercised to clean them thoroughly each time they are used. They are also required in filtering solutions: for this purpose, take a sheet or circle of filtering paper, fold it into four, then again into eight, open it fully and press it into a funnel; there will then be plenty of vent for the air to escape, otherwise the paper lies flat against the glass, and prevents the solution from pereolating through.

After taking the Negative on glass, a Pressure Frame is employed to produce the paper copies: they are made of various sizes, one sufficiently large to take the Negative with a small margin round it is recommended; and the back-board should be jointed, the utility of which will be seen from the description of its use, given under the head of 'Positive Printing' in a future chapter.

Fig. 15 represents a frame that is suitable for negatives of various sizes; a more simple form is manufactured at a lower price, but only available for one-sized negative.

For the purpose of holding solutions of silver, toning-bath, &c., in the operation of printing, provide two or three porcelain or glass dishes of various sizes, according to the dimensions of the paper. Glass dishes are recommended, for when porcelain pans are employed a distinct pan must be used for each solution.

Two or three glass rods, some clean linen cloths, and a wash-leather, will complete the requisites. The cloths should be rinsed in hot water after they have been washed, in order to free them from any trace of soap that might remain. An elastic India-rubber bottle may be useful to blow dust off the plates after they have been cleaned.



PRELIMINARY ARRANGEMENTS.



THE third, fourth, and fifth operations in producing a Collodion picture must be performed in a dark room: by this we do not mean absolutely a dark closet, but one protected from the *chemical rays of light*.

OPERATING-ROOM.

The readiest method is to obtain a small room, with a window facing the north, or otherwise shaded from the sun, and to cover the window with non-actinic muslin, or several thicknesses of (*chrome*) yellow calico, which *exclude the chemical rays* (yellow light not having any effect upon the sensitive preparations used in Photography); therefore

by darkening a room in this manner, there is sufficient light to observe our work without interfering with the chemical action.

The ordinary lemon-yellow calico is useless, but a special article is to be procured of most photographic dealers.

As calico in time fades and permits the actinic rays to pass, to the injury of the sensitive plate, it is advisable, where practicable, to glaze the window with ruby glass, which may be rabbeted into a sliding frame. This can be pushed on one side, so as to admit white light or secure ventilation, as required. A very efficient substitute for glass has been introduced, under the name of Non-actinic Muslin,* a single thickness being secure against all but direct sunshine. There is also a good Non-actinic Varnish, sold in small bottles; this is applied with a small brush and rapidly dries: it is of a deep ruby colour, and a plain glass coated on both sides may be considered safe against ordinary daylight; but if there is the chance of sunshine falling on it, an extra coating can be given. As this varnish is nearly transparent, more *non-actinic* light passes than through muslin or calico.

The most convenient position for the window is in front of the operator, and rather low: by this means the progress of development can be watched by looking through the photograph. If yellow daylight cannot readily be obtained, a candle or lamp may be used, provided the direct light is shaded by a screen of yellow calico or glass.

The room must be kept particularly free from dust and dirt (no carpet, mat, or rug on the floor), and a table or bench should be fixed immediately under the window, with a sink or basin, and pipe to convey the waste water; and overhead a zinc or wood tub, to contain a supply of water for washing, &c., which may be conveyed by a small pipe, fitted with a stop-cock of about $\frac{1}{4}$ -inch diameter: this will furnish a steady stream, and be more convenient than pouring from a jug.

Open-air Photography.—Professional photographers absolutely require a glass room or studio, not only as a protection from the weather, but in order to obtain control over the lighting of the sitter. There are, nevertheless, a number of effects possible to the amateur without its aid, and which are worthy of attention.

Unless the convenience of a glass room is to be had, Photographic Portraits are best taken in the open air: however, as it is not at all times convenient to do so, the photographer must arrange an apartment, according to the means he has at command; and in selecting a room he must bear in mind that it should not only have a good side-light, but also a skylight: a room receiving light from the north, or north-west, is preferable to others.

When operating in the open air the shadows are weak, and there

* Non-actinic Muslin can be obtained at Frederick J. Cox's establishment, price 9d. per square foot.

is a want of contrast; consequently the figure is flat, and without roundness. The best plan is to fix upon a corner, where there is a sufficiency of light from one side and front, the back and other side being partially protected: such a corner would be found at the junction of the side and end walls of most gardens. A screen can readily be suspended to protect the head of the sitter from the direct top-light.

If there is an open expanse of sky behind the sitter, it will be impossible to prevent fog from the mass of diffused light, and it is desirable to protect the lens by means of a cone of pasteboard, blackened inside.

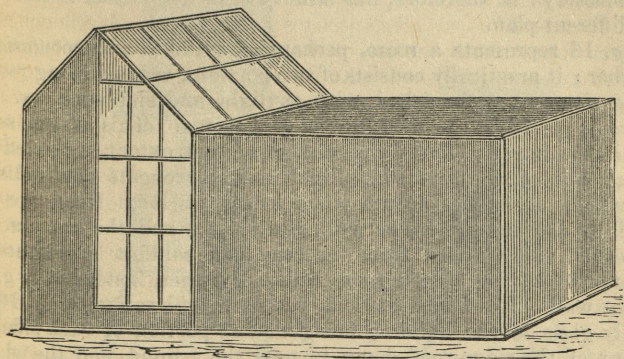


Fig. 16.

Arrangement of Studio.—A glass room should, if possible, be erected to command an uninterrupted expanse of northern light, which is generally steady, casting no abrupt shadow; and—unlike the south, from which the sun shines direct on the sitter—is not subject to troublesome fluctuations, rendering constant variations in the time of exposure necessary. The south end of the room should be built solid or opaque, as against this the backgrounds are fixed. The north end, also, is to be opaque for two-thirds its height, and painted a dark colour, to afford rest for the eyes. Over the head of the sitter it will be necessary to fix a screen, or to darken the glass by painting it, so as to weaken the top-light; else the hair will be overdone, or snowy, before the darker portions of the dress are sufficiently lighted.

To sum up the foregoing remarks, the principal source of light should be from above, falling obliquely, so as to leave one side of the face in a partial shadow.

A perfectly vertical light solarizes the top of the head, producing white hair and deep shadows under the eyes.

A horizontal source of light will destroy the shadows of the brow,

nose, and chin, giving a flat appearance to the face and a deathlike glaze to the eyes.

No direct light must enter from a horizontal source, or it will fatigue the eyes. This is most important, and is the reason why I have recommended the opposite end of the glass room to be painted dark.

The size and aspect of the studio is frequently beyond the artist's control, and circumstances compel the adoption of arrangements that are contrary to the recognised opinions of many successful operators. The original photographic studios were built almost entirely of glass, with a ridge roof from end to end. This, however, was found to be unsatisfactory; it, therefore, has latterly been the custom to erect them on a different plan.

Fig. 16 represents a room, perhaps as suitable and economical as any other; it practically consists of two portions, one end being reserved for the sitter, and furnished with skylight and side-windows. The Camera is placed in the dark tunnel or passage. This at once secures several advantages. The Camera is, to a great extent, protected from the entrance of injurious white light, and it prevents that indistinctness which sometimes occurs when lenses of long focus are used, caused by the atmosphere between the subject and the camera. But its greater value arises from the ease and comfort experienced by the sitter, in having a dark room before the eyes, instead of a glaring sunlight wall. It will be evident, from a consideration of *fig. 16*, that the only glass in the building being a small portion of each side, from the apex of the ridge roof down to near the ground, and the slanting roof on the north or east side, the remainder of the room may be constructed of corrugated iron, or wood. The windows must be provided with curtains or blinds, sufficient to completely close the light from either or both sides. Means for effecting ventilation, warming and decorating, are mere professional questions for the builder.

The width of the room may be about ten feet, and the total length from twenty to thirty feet; the height of the end wall must not be less than eight feet. It is against this wall that the background is fixed, which may consist of any even-coloured material that has a flat or non-reflective surface: a large blanket, tightly strained over a frame, gives a good effect; or cloth backgrounds of various shades, sufficiently large without fold or seam, can readily be procured. There are also a large variety of fancy backgrounds, with different scenes, which, if judiciously employed, are effective; yet for common purposes a plain ground is most serviceable, being, with the aid of a dark curtain, available for almost every subject, and it never appears conspicuous or obtrusive. A balcony, chairs, tables, or other ornaments, can be introduced so as to afford variety: with painted scenery a constant change is required, or the sameness becomes a characteristic of the studio, and gives vulgarity to the productions.

Arrangement of the Sitter and Focus of the Lens.—In a previous chapter allusion was made to the advantages of the rigid camera stands, two forms of which are shown. *Fig. 18* represents one of the cheapest and most useful that have been devised: it is very firm and light—just suitable for a small studio or garden, and its moderate cost* is not its least recommendation. But whichever form of stand may be in use, we may now suppose the Camera is fixed, and placed in front of the subject, at a distance varying from eight to fifteen or twenty feet: depending on the focus of the lens, and the amount of subject you require to include.

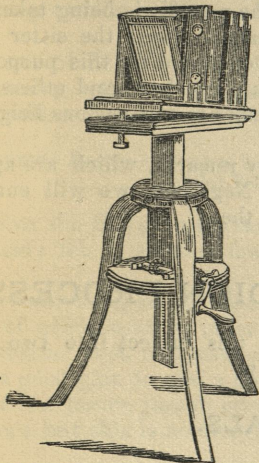


Fig. 17.

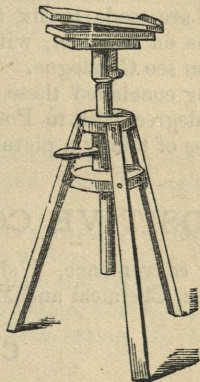


Fig. 18.

The operation of focussing is to insure sharpness of definition; and in order to observe the image on the ground glass, a dark cloth or velvet is thrown over the back of the Camera and head of the operator, so as to exclude all light except that which has passed through the lens. If the inverted picture seen on the focus-screen is not brilliant and sharp, the sliding body of the Camera is drawn out until the approximate position is found; and the final fine adjustment made by turning the milled-head screw of the rack-work.

In obtaining the focus of the object on the ground glass—an operation of delicacy, and on which depends the sharpness of the resulting picture—it is advisable to employ a Focussing Glass. They are made of several descriptions: the cheapest, and which magnifies the image to a considerable extent, is mounted in japanned tin; but the most perfect form of instrument is that shown by *fig. 19*, which possesses considerable power, and gives a large extended field. The price of this is 5s.



Fig. 19.

* These stands can be obtained from Frederick J. Cox, price 10s. 6d. each.

The attitude of the person sitting for the portrait must be left to the individual taste and judgment of the operator ; but avoid exaggerated postures, and allow the sitter time to get comfortably seated, and accustomed to the light, before the cap of the lens is removed. It will generally be found that the most pleasing effects are gained by taking side or three-quarter, in preference to the direct full face, and unless the whole of the figure is shown in the picture, similar to *carte de visite*, it is better only to include the head and shoulders. Paper pictures thus vignetted are very artistic.

As the slightest movement whilst the portrait is being taken causes a double image, it is frequently necessary to assist the sitter by some support for the head. Head-rests are employed for this purpose, some of which are made to fix to the back of a chair, and others support themselves on iron feet, with sliding tubes to suit various heights : for description see Catalogue.

Having concluded these preliminary remarks, which are applicable in every degree both to Positives and Negatives, we will enter upon the process of taking a picture. First, the

POSITIVE COLLODION PROCESS.



OR convenience, I shall divide this subject into two sections, viz. Chemical and Manipulatory.

CHEMICALS.

The Chemicals used in Photography are neither numerous nor difficult to obtain. For the Positive Collodion process the following solutions are required :—*Cleansing Solution, Iodized Collodion, Nitrate of Silver Bath, Developing Solution, Fixing Solution, Varnish.*

CLEANSING SOLUTION.*—Tripoli..... 2 drachms.
Water 2 ounces.
Nitric Acid 1 drachm.

Intimately mix the Tripoli and water, and afterwards add the Nitric Acid. This ought to be kept in a large-mouthed bottle and labelled. I will here caution the amateur against putting bottles away without previously labelling them, as it is impossible to remember, after a lapse of time, what each solution really contains.

Collodion is a most important chemical. It will be sufficient for our present purpose to state that it is formed by dissolving Gun Cotton in a mixture of Sulphuric Ether and Alcohol ; and iodized by

* Instead of this solution, a Detergent, called Lipaskathairon, may be employed. Frederick J. Cox is agent for the sale, and recommends it with confidence.

the addition of Iodide of Ammonia, or other salt. It is generally purchased ready for use, and up to a certain time improves by keeping. Where the whole stock would not be used in ten or twelve months it can be had in separate solutions.

As Collodion is extremely volatile, it must be carefully preserved from the air in close-stoppered bottles; and should it become too thick to flow evenly over the glass plate, it may be thinned by the addition of a few drops of pure Rectified Ether, until it is sufficiently limpid. It will be as well to remember, that it must not be used in the vicinity of a burning candle, or fire, as the vapour is inflammable.

Nitrate of Silver, for the Exciting Bath, should be recrystallized; and in making solutions in which this salt is employed it is advisable to use Distilled Water.

EXCITING BATH.—Nitrate of Silver..... 6 drachms.
Distilled Water 12 ounces.

Dissolve the Silver in the water, and afterwards add six drops of Nitric Acid; let it stand a few minutes and filter through filtering paper.

With some samples of silver it will be necessary to increase the quantity of nitric acid, in order to produce a clean picture, but it will be advisable to do so with caution or the details will be lost.

It is a good plan to coat a glass with Collodion, and leave it in the bath for a few hours, just to prevent the Silver eating the Iodide out of the film; but this is not very material.

Developing Solution.—There are several formulæ for making the Positive Developing Solution; either of the following may be used, the difference is chiefly shown by the nature of the deposit.

No. 1 gives a soft picture, full of half-tone; the whites are pure, and devoid of metallic glare.

No. 2 gives a bolder picture, but not so full of fine detail, and owing to the presence of Nitric Acid, the silver deposit has a metallic appearance.

No. 1. First dissolve—

Proto-Sulphate of Iron..... 4 drachms.
Distilled, or Soft Water 10 ounces.

In another vessel dissolve—

Nitrate of Lead $2\frac{1}{2}$ drachms,
Distilled, or Soft Water 10 ounces,

and pour the whole of this into the Solution of Iron: a white insoluble

deposit is immediately thrown down, which is removed by filtering, and the following acids added:—

Glacial Acetic Acid	2½ drachms.
Formic Acid	1½ „
Alcohol	2 „

The Iron and Lead dissolve more readily in hot water, and as it is rather a slow process a small pestle and mortar is useful, but the acids must not be added until the solution is cold.

This developer, when first made, has an apple-green tint, and is a solution of Proto-nitrate of Iron, which gradually oxydizes and becomes brown; it thus loses its strength, but can be revived by the addition of a small quantity of Proto-sulphate.

No. 2 is a good useful developer, especially suitable for beginners: the chemicals can be put into a bottle and occasionally shaken until dissolved, then filter.

Proto-sulphate of Iron.....	1 drachm.
Water	3 ounces.
Glacial Acetic Acid	1 drachm.
Nitric Acid	3 drops.
Alcohol	1 drachm.

The Proto-sulphate of Iron is the developing salt in each of these solutions, the Acetic Acid being present as a retarding agent: without it the plate would immediately fog. An excess of acid makes the developer very slow, and spoils the colour of the picture. The Alcohol facilitates the solution in flowing over the plate, and enables the developer to more readily combine with the wet collodion surface; the quantity required varies considerably: with a new bath less than that stated in the formula may be used, but when the bath solution has become saturated with Ether, &c., more is requisite.

Fixing Solution.—*Cyanide of Potassium* is generally used for this solution,; the proportion being ten grains to the ounce of water: but as it is highly poisonous care must be taken to prevent accidents. The weak solution used for fixing is not likely to injure the skin, but it would inflame a scratch or wound. It is a common practice to rub the hands with a small portion, to remove stains; but a peculiar soap is now kept by most dealers which is far safer. India-rubber gloves or finger-stalls are made to protect the hands. Hypo-sulphite of soda answers the purpose quite as well, and is free from the objectionable fumes and dangers of cyanide. It is prepared thus:

Hypo-sulphite of Soda.....	5 ounces.
Water	1 pint.

These solutions may be made in quantity, as they will keep good almost an indefinite length of time, except the developing, which ought not to be made more than two or three weeks before it is wanted.

MANIPULATION.

At page 2 we have stated that there are seven distinct operations in the Collodion process. Assuming, therefore, that the apparatus and chemicals have been prepared as previously directed, we will proceed to take a picture.

Cleaning the Plate.—The Glass should be cut from the best polished Crown; and the edges ground, to prevent cutting the fingers. Having selected glasses free from blemish, proceed to clean them by washing with water, in which a little Soda has been dissolved; this frees them from grease. They should afterwards be rinsed in water, and wiped dry with a clean linen cloth; then mark one side, and rub it well with a piece of cotton wool, using the *Cleansing Solution** (page 14): again wash the plate with water, and wipe perfectly dry; now lay it on a flat board or plate-holder (*fig. 6*), and polish with a wash-leather. By breathing on the glass the surface is more easily seen, and if smears are visible wash and clean the glass again. It is better to prepare a stock before commencing operations, and stand them by in a plate-box until required. Glasses that have been previously used are very difficult to clean, more especially if the film has been allowed to dry; when you have a perfect surface, remove with the elastic bottle, or soft brush, the loose dust which has settled on the plate, and proceed to give

The Collodion Coating.—Hold the plate as near level as possible, by the corner marked 1, *fig. 20*, between the fore-finger and thumb of

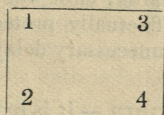


Fig. 20.

the left hand; then into the centre of the glass form a good pool of Collodion, giving the plate at the same time a slight inclination, to cause it to flow in the direction of corner No. 2. By tilting the plate a little on one side it will run towards the corner it is held by, taking care that the Collodion does not touch the thumb; and by again giving the glass a fresh slant, corners 3 and 4 are covered: the superfluous quantity is poured off at the corner marked 4, and returned into the bottle. By keeping the plate in a vertical position, and giving it a rocking motion, the formation of streaks in the film is prevented, otherwise the surface

* If Lipaskathairon is used, there will be no occasion to wash the glass with soda and water.

will be covered with a number of fine lines, technically termed 'crapy.' A short period is allowed for the Collodion to set, varying from one to two minutes; in warm weather, perhaps, half a minute is ample. A good guide is to touch the lower corner of the plate, and if the film is gelatinous and receives the impression of the finger, it is ready for immersion in the Nitrate Bath, which is called

Exciting the Plate.—Up to this point the manipulation may be conducted in daylight; but as the immersion of the collodionized plate renders it sensitive to light, recourse must be had to a dark room or closet, as described at page 9: in default of this convenience, the work may be performed by the light of a candle, shaded by a screen of yellow calico or glass. Lanterns with yellow shades are made for the purpose.

The Dipping Trough (*fig. 8 or 9*), having been filled with the Exciting bath, place the prepared glass on the Dipper, and immerse it in the Silver Solution, steadily, but without hesitation, as the slightest pause will produce lines, which afterwards show in developing. When the plate has remained in the Nitrate of Silver Solution about a minute it should be withdrawn, and, without pause, again immersed two or three times, to insure the proper action of the Silver upon the Iodide in the Collodion: this takes from two to three minutes, and is known by the film ceasing to have the greasy appearance it at first presents. When this is the case it should be withdrawn from the bath, and stood on some blotting-paper, just to drain, and then it is ready for exposure in the camera.

The plate being drained from the excess of Silver Solution, but not dried, it is placed in the dark side of the Camera (*fig. 5*, page 6), the collodion side being downwards: close the wood shutters of the slide, and the sensitive film is effectually protected from injury by light; therefore proceed, without unnecessary delay, with the fourth operation, viz:—

Exposure in the Camera.—It is requisite here to recall attention to the instructions given under the head 'Arrangement of Sitter,' at page 13; but premising that the Camera has been prepared, and the adjustment of light determined previous to commencing operations, just look at the image on the focus-screen, to satisfy yourself that the greatest degree of sharpness is obtained, and replace the cap of the lens; insert the frame containing the Collodion plate, and desire the sitter to look steadily at a *dark* object about the height of the Camera; then raise the shutter of the dark slide, take off the cap of the lens, and give the necessary exposure, which will vary with the intensity of the light, the power and aperture of the lenses, or the condition of the chemicals. In an ordinary light, from six to ten seconds is the average time required: this will be known by the appearance of the plate in development, and experience affords the only guide.

Having exposed the plate, you must close the sliding shutter and return to the dark room, to

Develop the Picture.—On removing the plate from the Camera there is not the slightest trace of an image visible, but it quickly makes its appearance by aid of a *Developing Solution* (page 15).*

Having carefully excluded white light from the operating-room, hold the glass by the corner, and pour on a sufficient quantity of the *Developing Solution*. Begin by pouring it on at one edge, and gently inclining the plate to let it flood the surface with a uniform wave—if it does not flow evenly a stain will inevitably be formed; the first effect is the appearance of the strong lights, then the half-tones, and finally the darker shades. For instance, in developing the portrait of a gentleman, the shirt-collar, face, and hands, are first to appear; the progress must then be carefully watched, and as soon as the creases or shadows of a black coat are seen, wash with a gentle stream of water, and it is ready for fixing.

To Fix the Image.—The Picture having been well washed, and the *Developing Fluid* thoroughly removed, the film is rendered insensitive to light; therefore the door or window of the dark room may be opened, more readily to observe the action of the fixing agent (page 16). Pour this mixture over the plate in the same manner as the *Developing Solution*, until all the creamy appearance is dissolved; when that is the case, it must be again washed in a good supply of water and set up on edge to dry.

It is a very good plan to have the fixing solution in a shallow pan, and drop the picture into this. It can be removed from the pan by a wire hook, because it is most essential to avoid contaminating the hands or cloths with *Hypo-sulphite of Soda*, the slightest trace of which on the glass plate or in the silver bath is fatal to success.

We are now enabled to form an opinion as to the success of our manipulation. If the strong lights of the picture, such as the face or shirt front, make their appearance simultaneously with the half-tones, and the picture presents a pale-white *washy* tone, the exposure has been too long; but, on the contrary, if, after developing some time, only the high lights make their appearance, let the next plate remain longer exposed in the camera.

The Collodion film being tender and liable to rub, it must be protected from injury in some way, which brings us to the last operation, called

Varnishing and Setting.—The usual way of doing this has been

* The *Developing*, *Fixing*, and *Bath Solutions*, can be obtained from my establishment, 26 Ludgate Hill, ready prepared, and fit for immediate use.

to cover the surface with a transparent varnish; the best for Positives is known as 'Sohnee' varnish. The plate, when thoroughly dry, is gently warmed, either before a fire or over a spirit-lamp, until it is as hot as the hand can comfortably bear; the varnish is then poured over the surface in the same manner as collodion, and the drying completed by the application of more heat. A thick band or ridge is sometimes formed along the edge, or at one corner; this is readily removed by means of a piece of blotting-paper before the varnish has set.

Some practice is required to do this simple operation nicely. If the glass is not sufficiently warmed the varnish dries dull, giving the appearance of ground glass; and when made too hot, the spirit flows over the plate, as if the surface were greasy, forming thick lines or bands across the picture.

When the varnish is applied, the film occasionally has a tendency to dissolve; this arises from the spirit being too strong for the particular sample of Collodion, or from excessive heating the plate. A *thin* coating of gum-water run over the picture after the fixing solution has been washed off will obviate this misfortune, as well as protect the film from cracking, which is another annoyance sometimes met with.

A picture that has been carefully and cleverly varnished is proof against damage by any fair usage. The surface should be bright, smooth, and free from specks or spots, which frequently arise from floating particles of dust, want of brilliancy from the plate not having been clean, or thoroughly free from the salts left in drying off the fixing solution, and uneven from an excess of temperature in warming the glass.

The varnish should not be poured from the stock-bottle, but a small portion decanted into one with a broad flat rim, so that it can be poured readily on the picture without splashing or running over the sides; and as it might become contaminated by the before-mentioned specks of dust, there is not the risk of spoiling the whole stock, but only the smaller quantity which is actually in use.

The picture is now finished, and may be mounted in a frame or case, with a piece of black cotton velvet behind; or it can be varnished with jet varnish, which should be applied with a small brush to the plain side of the glass, and not on the Collodion surface. In mounting the pictures, put them into cases or morocco trays, with gilt mats, which are suitable for hanging up. If a *Passe-partout* is used, it ought to be of a dark colour, as the white ground will, by contrast, spoil the tone. When properly finished and mounted, the lights and shades are equal to a *Daguerreotype*.

NEGATIVE PROCESS ON GLASS.



HE production of a Negative picture depends on the time of exposure and the nature of the solutions used in developing ; with these exceptions, you will proceed in precisely the same manner as for Positives.

But, first, it will be advisable to clearly understand what is meant by the terms Positive and Negative, as applied to Photographs on Glass.

A Positive picture, when laid upon a black cloth or other dark material, shows the lights and shades in their natural positions : thus the coat is transparent, and allows the dark backing of the picture to show itself through the Collodion film ; whilst the opaque portions of the picture (such as the face or hands), will appear white by reflection from the silver that has been deposited there ; but if it is held up and viewed as a transparency, the face, hands, and other light parts appear *slightly* opaque or black, while the shadows, being transparent, allow the light to be seen through them.

A Glass Negative is, in reality, an over-exposed and over-developed Positive. When laid upon a dark ground, to a certain extent it will show as a Positive, but not effectively, for the gradations of tone are not to be distinguished, and the shadows of the picture appear to be slightly foggy ; but viewed as a transparency, the whole of the detail is faithfully seen : a Positive picture is also Negative when viewed in this manner, but not of sufficient *intensity* to yield a copy on paper.

Presuming that the operator understands the peculiarity of the picture he is desirous of producing, we will now progress to the preparation of the

CHEMICALS.

Cleansing Solution.—Directions for making this will be found at page 14, under the head ‘Chemicals for Positive Process.’

Negative Collodion differs from Positive, not only in the thickness of the film, but also in the preparation of the Iodizing Solution. Negatives require a greater amount of opacity, while the colour of the picture is of no importance, provided it is not foggy. There are several good Collodions made, but among the best are Mawson’s, or Blanchard’s. We manufacture a Collodion that is extremely well suited for Iron Development ; and as we guarantee it to be made from pure spirit there is not that risk of injuring the bath, which frequently arises when methylated spirit is employed. See Catalogue.

These Collodions retain their sensitiveness for several months, and appear to undergo no perceptible change during that time.

EXCITING BATH.—Recrystallized Nitrate of Silver..... 4 drachms.
Distilled Water 1 ounce.

Also, make a solution of

Iodide of Potassium 4 grains.
Distilled Water 1 ounce.

When the silver is dissolved, pour one drachm of the Iodide Solution into it. A yellow curdy precipitate is at once produced, but it soon re-dissolves. Now add seven ounces of water, and the solution once more becomes thick and milky, from the fine precipitate of Iodide of Silver which is again formed. After standing a few hours it can be filtered, and should be perfectly bright and clear.

The Iodide of Potassium is introduced for the purpose of feeding the bath with Iodide of Silver. There are many indirect methods of doing this; perhaps the simplest plan is to dissolve the Nitrate of Silver in Distilled Water, then coat a large glass with Collodion, and let it remain in the bath for five or six hours: the Nitrate then attacks the Iodide in the Collodion film, and no further difficulty will be occasioned. Some writers recommend the addition of a few drops of Collodion to the bath, but there are objections to this course.

The Silver Solution will be either neutral or acid; an Acid bath will destroy the colour of blue litmus paper, and turn it red, therefore litmus paper is used as a test of acidity.

A Neutral Silver bath works quicker and with less liability to hardness in the negative than one containing acid, but requires more care and greater security from impurity or dirt. It is advisable to add a drop or two of Nitric Acid, until the blue litmus paper is slightly reddened.

Developing Solution.—There are several formulæ for Developing Solutions. The following gives good results for general purposes:—

Proto-sulphate of Iron 2 drachms.
Glacial Acetic Acid 2 drachms.
Water 8 ounces.
Alcohol about $\frac{1}{2}$ an ounce.

As the Alcohol plays no part in the development of the image, but is only used to make the developer flow freely, and mix with the nitrate solution on the plate, the proportion may be varied: it is a rule to use as little as possible; an old bath, being fully charged with ether and alcohol, requires a larger proportion of alcohol in the developer than a new one.

Re-developing or Intensifying Solution.—As it rarely happens, except with special subjects, that the Negatives acquire sufficient

intensity under the action of the developing solution, the application of a re-developing or intensifying solution is necessary. This may consist of a solution of Pyrogallic Acid, with the addition of Citric Acid and Nitrate of Silver, as follows:—

No. 1.	Citric Acid.....	25 grains.
	Pyrogallic Acid.....	10 grains.
	Distilled Water.....	2 ounces.
No. 2.	Nitrate of Silver	10 grains.
	Distilled Water.....	2 ounces.

No. 1 should be made fresh, as it will not keep more than a few days. No. 2 will keep indefinitely. At the time of using, a mixture is to be made of equal parts of Nos. 1 and 2.

Fixing Solution.—Cyanide of Potassium has been commonly used for fixing, but owing to its poisonous nature it is advisable to use Hypo-sulphite of Soda, which is perfectly harmless. The formula will be—

Hypo-sulphite of Soda	5 ounces.
Water	1 pint.

This solution must be carefully kept from the glass plates, and the cloths that are used to clean them, as the slightest trace leaves its mark. Therefore take especial care in this respect.

MANIPULATION.*

Clean the Glasses in the same manner as directed for the Positive process, but remembering that for this purpose it must be really flat; large sizes should be cut from patent plate, or the Negative will assuredly be broken in the pressure-frame. The edges may also be roughed in order to give a bite to the Collodion, lest the water should get under the film and detach it from the glass. It is almost sufficient to rub the edge of one plate along the edge of another, which removes the sharp cutting angle; but if requisite, a piece of notched stone can be employed, which grinds or scratches the glass for about the eighth of an inch on the surface. Then proceed to

Coat with Negative Collodion, which ought to have been allowed to settle; the clear portion should be decanted into a clean bottle for use. The Collodion coating is applied in the same manner as for Positives, and then

Sensitized by immersing into the Nitrate bath, prepared as directed at page 22. The plate should remain in the Exciting bath from

* It is assumed that the operator is tolerably well skilled in the Positive Process; should that, however, not be the case, it will be necessary for him to read the article on Positive Manipulation, p. 17.

three to four minutes, during which time it may be raised once or twice, *but on no account must it be lifted out of the solution until it has been immersed at least a minute.* When the film presents an even surface, carefully drain off the excess of Silver Solution, and lay the glass plate in the dark slide of the Camera, and it is ready for

Exposure in the Camera.—After having exposed the plate, which (other circumstances being equal) will be about double the time required for a Positive, proceed

To Develop.—The dark slide must again be removed into the operating-room, and the greatest care having been taken to exclude white light, pour the Iron Developer quickly and evenly over the plate, or lines and irregularities will occur. The best plan is to cover one end of the glass first, and, by slightly tilting it, the mass of the fluid will flow over the surface in an unbroken wave; now give it an undulating movement, so as to keep the Developing Solution in motion, and thereby cause it to amalgamate with the silver on the film: no more developer should be poured on the plate than it will contain without overflowing, for by doing so you lose the benefit of the small quantity of Bath Solution originally on the surface.

It is advisable to prolong the development until the detail is fully brought out; but at the same time it is necessary to avoid all trace of deposit on the shadows, which must remain clear and transparent.

Now wash the plate and thoroughly remove the Iron Solution; and because it has a great repulsion for water, a continued stream is requisite.

We here have an opportunity of examining the picture and forming an estimate as to its probable success. Assuming that the chemicals are in their proper harmonious condition, there should be some small portion of the film perfectly clear and transparent, to represent the dark shadows of the picture; such, for instance, as the folds in a black coat or mantle: from this there must be a perfect gradation of tone, showing the detail in every respect, until we finally reach the strongest lights, which are represented by an *almost* perfect opacity. It is most probable, all things being in good order, the plate presents an appearance similar to the above description, but without sufficient intensity to produce a good print; therefore it becomes requisite to increase the density by re-developing with a solution of pyrogallic acid and silver.

A great deal of trouble and uncertainty may be saved by a beginner, if he have a properly exposed and developed negative at hand, for the purpose of comparison: we have been so repeatedly requested to supply a sample, that we have made arrangements to keep a few in stock; they can be sent post free for 14 stamps.

To resume the manipulation:—After the plate has been washed it can be stood on one end to drain; for which purpose a draining-stand (*fig. 21*) may be advantageously employed; and in a chemically clean measure pour sufficient of the Intensifier, No. 1 (for a glass $4\frac{1}{4}$ by $3\frac{1}{4}$ inches, perhaps one drachm may be required); to this add one drachm of the Silver Solution, No. 2.

This mixture must be made in the dark room, and used immediately, and when the plate is fully covered, it should be raised at one end, and the surface drained back into the measure: this intensifier is then reapplied to the plate, and so on again and again until the requisite increase of density is produced. By looking through the picture every time it is drained, a knowledge is gained of the progress of the operation; and when sufficiently intense, the surface is once more to be flooded with water and washed. It is now ready to be

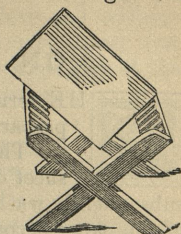


Fig. 21.

Fixed, employing the Solution (page 23). It can be poured over the plate, and the surplus returned to the bottle.

Many operators have a shallow dish to hold the Hypo-sulphite Solution and immerse the picture into it. At this point daylight may be admitted into the room, and by so doing it will be easier to discover when the Iodide is dissolved.

After fixing wash away all trace of the chemicals, which, if allowed to remain, would thoroughly spoil the picture. Too much care cannot be taken in this respect. When dry and varnished, you may print from them any number of Positive copies, without injury to the original.

Varnishing.—There are several descriptions of Varnish for Negatives; some are used cold, and others require the plate to be warmed. They are all applied by flooding the surface; and, among others, the following can be recommended as hard, transparent, and not liable to stick to the paper when printing.

Amber Varnish is convenient for an amateur to employ; it is simply poured on the plate, and then drained off at the lower end into the bottle. The solvent, being chloroform, rapidly evaporates. On no account should the glass be warmed, but it must be perfectly dry.

Spirit Varnish gives a remarkably hard and permanent coating to the Negative. The plate must be previously warmed to about blood heat, the varnish is then poured on, and the drying completed by more heat if it shows any indications of drying dull.

After varnishing and drying the Negative may now be considered finished, and if good, preserved in a plate-box until required for printing; but if bad, to avoid further trouble unhesitatingly smash it at once.

PRINTING PROCESS.

ON ALBUMENIZED PAPER.



THE term Printing means, the formation of Positive copies on prepared paper, from the Negative previously obtained.

The plan most generally adopted has been to saturate a sheet of paper with a solution of an alkaline salt, drying and subsequently washing with Nitrate of Silver, by which means the surface of the paper becomes covered with a chloride of that metal.

At this stage of the operation the paper possesses the property of turning black by exposure to the usual white or common light, but will retain its colour for a considerable time if kept in the dark: it is the possession of this property that renders it available for Photographic purposes. For example, take a sheet of sensitive paper, lay a piece of net or lace on its surface, and press them into close contact by means of a glass plate; expose this to the rays of the sun, when the paper rapidly begins to darken round the exposed parts, and in a few minutes becomes nearly black: but on removing the lace the shadow will be almost white and unchanged, giving an outline of the net or object that had covered it. To render the paper further unchangeable, it is necessary to fix the image by removing the sensitive salts, and we then have a permanent impression.

The apparatus required is very simple, being a pressure-frame, three or four shallow porcelain or glass pans, a few pairs of forceps to remove the paper from the solutions, and some pins or clips to suspend the paper whilst drying.

CHEMICALS.

The Chemicals employed are Nitrate of Silver, Hypo-sulphite of Soda, Chloride of Gold, Acetate of Soda, Washed Kaolin, and Albumenized Paper. This paper can be purchased ready albumenized, fit for immediate use; and as there are many difficulties in its preparation, it will be found better to procure it than to risk the success of the future operations by attempting the manufacture.

Exciting Bath.—Make a solution of

Nitrate of Silver	4 drachms.
Distilled Water	5 ounces.
Nitric Acid.....	1 drop.

This solution may be made in any quantity, and will excite a great number of papers; but as it rapidly becomes discoloured, an ounce of Kaolin must be kept in the bottle, and after the day's work is done pour back your solution and shake it well up. When the Kaolin has settled the top portion can be filtered, and will be bright and clear.

Toning Bath.—There are many different formulæ and modifications of the same formula, employed with success for toning the picture; but to render the progress of the student clear and without embarrassment by a multiplicity of directions, I here only insert *one*, which has been proved good and easy to work: in the Appendix at the end of this book there are others, which give different tones.

Therefore dissolve, in a large bottle,

Acetate of Soda	1 drachm,
Distilled Water	10 ounces,

and to this add 2 grains of Chloride of Gold.

The Chloride of Gold is generally purchased in small bottles, containing from 15 to 60 grains; it is extremely deliquescent, liquefying by absorbing moisture from the atmosphere: therefore, as it is an impossibility to weigh out a small quantity like two grains with any regard to accuracy, the best plan is to dissolve at once the whole contents of the bottle in a given proportion of distilled water: for instance, if the 15 grains which the bottle is supposed to contain are dissolved in $3\frac{3}{4}$ ounces of water, 2 drachms of the solution will contain 1 grain of chloride of gold. In this condition it may be kept a considerable time without injury, and, when a grain is wanted, 2 drachms can be measured off without difficulty. The above proportion is that usually adopted by the retail trade in making up the *Chloride of Gold Solution* for sale.

The Toning bath should be made at least twenty-four hours before required for use, and will retain its active properties for several weeks.

Fixing Solution.—Dissolve

Hypo-sulphite of Soda	4 ounces.
Soft, or Distilled Water	1 pint.

To be used fresh, so do not mix more than required for immediate use.

MANIPULATION.

When the solutions are prepared select a sheet of albumenized paper. The first operation is to

Excite the Paper.—Filter sufficient of the Nitrate of Silver Solution into a shallow glass or porcelain* pan, to cover the bottom to the depth of half an inch. Then take a sheet of paper cut to the required size, and holding the two ends by both hands, let the centre drop until the albumenized surface touches the solution; then carefully lower the ends and leave the paper floating on the bath. If this is done slowly, and with ordinary care, the air-bubbles which might have formed underneath will be expelled. The back of the paper must be kept perfectly dry.

* If porcelain pans are used they must be strictly kept to the same solutions, for the glaze soon cracks, and they imbibe the chemicals. Ebonite trays are convenient, but if dirty they are not so readily detected.

The time required for the silver to act on the chloride in the paper will be about three minutes; when it lies flat and the ends cease to curl up, it may be considered fully saturated, and should be removed by lifting one corner with a pair of forceps and hung on a line to dry, either by means of pins previously coated with varnish to protect them from corrosion, or with clips. The glass clips are most convenient and safest, they can be procured for 1s. 6d. per dozen, therefore expense cannot be any hindrance to their employment.

This portion of the manipulation is done in the dark room, as the paper is sensitive to white light.

The Exciting Bath should be frequently tested with a Bath Tester, to prove it of the proper strength. These instruments are made in several ways, but one in the form and on the principles of the Hydrometer is generally used; they are divided up the stem from 0° to 80° , and show the number of grains of silver to the ounce of water, by the degree at which they float: thus, in plain water the surface of the liquid cuts the scale at 0, but when there are 30 grains of silver in the oz. of water the scale floats at 30, so in proportion for other points. *Fig. 22* represents one of these instruments, with an immersion tube or trial glass, which is a cylindrical vessel about six inches long. The bath to be tested is poured into this glass, and the Hydrometer floated in it, as before described; only it is as well to observe that this test will not be accurate if other chemicals, such as Nitrate of Soda, have been dissolved in the solution.

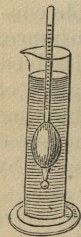


Fig. 22.

The albumenized paper, when thoroughly dry, may be at once passed on to the next stage of operation, or, if more convenient, kept in a portfolio, or book, for ten or twelve hours.

In another portion of this book will be found a method of sensitizing paper, so that it may be kept some time before used.

Printing the Positive.—Take a pressure-frame into the dark room, remove the back-board, and lay the Negative on the plate glass of the frame, with the Collodion side upwards, and cover it with a piece of sensitive paper, prepared side next the Negative; replace the back-board and bring them into close contact by closing the crossbars.

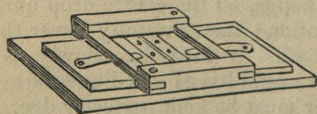


Fig. 23.

The Pressure-Frames (*fig. 23*) are made without a glass, the negative fitting into a rabbet; they are principally used for small-size plates.

The pressure-frame is now turned up to the direct light of the Sun, and the operation of Printing commences.

How long the paper will be in attaining sufficient force or intensity

depends upon the actinic power of the light and density of the negative, but it can be readily examined by opening in the dark room one half the back-board of the frame: presuming that you are printing a portrait, allow the process to continue until the detail of the face is perfectly well defined; in fact, the proof must be a few shades darker than you require the finished picture, as it loses colour in the fixing process.

When thoroughly printed the prints may be preserved for a few hours in a dark box or portfolio, or you can at once commence the

Toning Process.—Toning the picture previous to fixing is necessary for two reasons:—First, the colour it presents is anything but artistic; and, secondly, toning is a preservative, giving a permanence, without which it is valueless.

To obviate this the prints are treated with a solution of gold, the silver in the paper combines with the gold and thus the silver picture is to some extent changed into a gold picture.

As soon as the prints are removed from the pressure-frame, wash in several changes of water to remove the Nitrate of Silver; they are now ready for the toning bath, therefore immerse them in a glass or porcelain pan nearly filled with the solution, page 27.

The number of prints in the pan must be regulated by its size, but there should not be more than are readily attended to, for whilst toning they must be kept in motion by means of a glass rod.

The colour of the picture soon begins to change from a brick-red to a brown, and so on to a purple-black. When this is attained it is again washed in water, and removed to the Fixing Process, which is the last operation. The time required depends on the temperature of the operating-room, and the strength of the bath: if it is new and rich in gold, a good purple-black is obtained in about five minutes, but when the gold has been partially worked out of the solution double that time will be required.

The variations in the colour of the prints are more readily observed in *weak* daylight than by yellow or artificial light, but as the paper is, to a certain extent, still sensitive, it must not be exposed to the light more than is necessary; when the purple-black stage is reached the prints should be immediately removed, or they pass into the blue-slate colour, which is very objectionable.

When toned and washed the undecomposed chloride of silver in the paper is to be removed, termed

Fixing the Print.—Use the Hypo-sulphite of Soda Solution described at page 27. The picture is immersed in this for about twenty minutes, and then again washed in water for ten minutes or a quarter of an hour, after which it may be left soaking in fresh waters, frequently

changed for ten or twelve hours: it is preferable to leave it in a vessel of water under a tap, which is constantly dripping.

As the Fixing Solution reduces the depth of the print, it should be over-printed in the first instance to allow for this reduction, else the detail of the picture will be lost.

The Fixing Solution *must be new*; after a number of pictures have been fixed it should be thrown away, not because it ceases to perform its work, but because the sulphur which is liberated from the soda acts upon the paper, and will cause the ultimate destruction of the photograph: half a pint of solution is capable of fixing about two dozen pictures six inches by five inches, after which it ought to be discarded and a fresh bath made.

Mounting.—The prints having been thoroughly washed and dried, procure a sharp knife and cutting-shape, which is a piece of thick glass with bevelled and polished edges; place the print face upwards on a slab of glass, and over the print lay the shape in such a position as to include the best portions of the picture; hold it firmly down with the fingers of the left hand, and cut through the picture along the edge of the shape: it requires some skill to avoid ragged edges, and can only be done with a sharp knife and a bold, firm cut.

Dextrine appears to be a suitable adhesive substance for attaching the picture to the mounting-board; it is prepared by mixing a small quantity with sufficient water to work into a stiff paste, then rapidly pour *boiling* water over it, continually stirring to insure perfect mixing. It should not be much thicker than cream, and must be freshly made, for when sour there is danger of causing the print to fade. Gelatine or Starch Paste may be used instead of Dextrine, but professional mounters employ good Scotch glue.

Use stout cardboard, and if it is intended to leave a margin round the picture, let it be of a buff or yellow colour; at all events avoid a blue tinge, which spoils the tone of the print. The surface of the cardboard should be slightly dampened with a moist sponge to cause it to expand, and the Dextrine or Glue applied to the back of the picture with a moderate-sized brush; then carefully lower the print, lay a piece of clean blotting-paper over the face of it, and rub pretty strongly with a cloth to expel the air-bubbles and insure contact: when nearly dry, place under pressure for a few hours.

It is desirable to put the pictures through a rolling press, to lay the grain of the paper and give a finish to the surface. Presses of a small size are made very cheap, and are quite powerful enough for ordinary use.

A Machine capable of rolling Carte-de-Visite Portraits with complete satisfaction is shown by *fig. 24*;* the small roller revolves freely on its axis between the long arms of the handle. At the lower end

* Manufactured by Frederick J. Cox: price, with steel roller, 21s.

these arms are fixed to a pin passing through the large roller, which is fixed immovably to the bottom board.

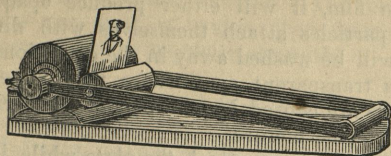


Fig. 24.

To use the machine, place the card in the position shown by the woodcut; then raise the handle, and the card is pressed between the rollers. Any degree of pressure may be obtained by means of the screws at the end of the arms which draw the rollers into contact. It is essential in using this or any other press to observe that the pressure is uniform on both sides, else the card is strained or elongated on one edge.

We also make a machine of a larger size with two rollers, suitable for pictures up to half-plate or cabinet size, price 35s., and which is most useful to professional photographers.

A better surface is given to the pictures if they are passed through the press before they are quite dry.

FAILURES:

THEIR CAUSES AND REMEDIES.

THAVE endeavoured to describe the manipulation of the different processes in as concise and brief a manner as possible, so that the necessary operations might follow each other intelligibly and without confusion. The minutiae and little peculiarities which injuriously affect the picture will now be practically considered.

Positive and Negative Collodion Process.—There are difficulties in the Positive and Negative Process equally common to both, and are principally caused by

Opaque and Transparent Spots.

Fogginess.

Feebleness, or Want of Contrast.

Hardness or Excess of Contrast.

Streaks and Stains.

Tender and Rotten Films.

Opaque and Transparent Spots.—Dust, principally dust, is a difficulty that first demands our attention; if observed on the plate

before the Collodion is poured on the remedy is obvious, but do not clean the glasses in the same room as you coat the plates. If dust settles on the Collodion film, it will either produce opaque or transparent specks, for the particles attach themselves with different degrees of tenacity; some will be washed away in the operations of developing or fixing, leaving a transparent spot where they have shaded the film, while opaque spots are caused by the particles adhering firmly and becoming imbedded in the picture.

The dust does not always attack the plate while in the dark room, for many cameras are provided with receptacles in the form of bellows bodies, and unless they are occasionally wiped out an unfailing supply will be furnished. Another failure arises from small pieces of dried Collodion floating over the plate; this is avoided by carefully wiping the neck of the bottle before using it.

Another difficulty, which is the sediment of Collodion, occasions more trouble. Collodion, after standing a few days, leaves a deposit, called 'bottoms;' and the only precaution that can be taken is to have a large bottle kept full, holding from four ounces to a pound, according to the quantity consumed, and, when required for use, an ounce or so may be carefully poured off into a smaller bottle. Long bottles (*fig. 13*) with a lip and stopper, made expressly for this purpose, can be obtained, from one to two shillings each, and will be found extremely useful.

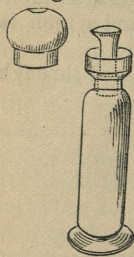


Fig. 25.

A very improved form is shown by *fig. 25*, it effectually prevents particles of the film from drying round the neck of the bottle, as the spout is inside the cap, and the vapour of the ether prevents it from setting. These are sold at 2s. 6d. each for the 2-ounce, and 3s. for the 4-ounce.

Should the Collodion become dirty, or full of floating particles, there are two methods of clearing it: one is to stand it by for some time, and when bright, decanting the clear portion into a fresh bottle; or it may be filtered, for which purpose the Collodion Filter (*fig. 26*) is required. The Collodion is put in the upper globe, into the lower part of which a plug of cotton wool is fixed; this globe fits air-tight into the long bottle, and as the Collodion filters through the air escapes from the lower chamber to the upper by an internal pipe: by these means evaporation of the ether is prevented, which otherwise would spoil more Collodion than filtering would save. The price of these filters is 6s. 6d. each.



Fig. 26.

Transparent spots are sometimes caused by undissolved particles of Iodide in the Collodion; a few drops of weak alcohol may improve it, but at the risk of rendering the film rotten. The most common cause of pin-holes, or

transparent spots, is an excess of Iodide in the bath, termed Iodide of Silver: it is a crystalline deposit, that frequently occurs with an old bath, especially in warm weather. The remedy is to dilute the solution with its own bulk of water, then filtering and adding Nitrate of Silver to make up the requisite strength.

Fogginess resembles a thin veil or deposit, sometimes over the whole of the picture, and sometimes only partially over the shadows: chemical fumes, bad drains, leakage of gas, wet paint, and dirty glasses, all conduce to cause or increase it, but the general source is *bad condition of the Nitrate bath*, the effect of *diffused light* either in the camera or dark room, or *over-exposure* in the camera.

A simple means of determining if the fault is in the chemicals is to coat, sensitize, and develop a collodion plate without leaving the dark room. After it has been removed from the bath pour on the Developing Solution, let it remain a minute, then wash off, and remove the Iodide of Silver by aid of the Fixing Solution. The plate should now appear clear and transparent: if that is the case the chemicals are right, and the fogging must arise from solarization in the camera. Assuming the chemicals are in working order, and a plate passed through the various operations of developing, &c., remains perfectly clear, proceed to examine the camera: the fault frequently is in the sliding shutter of the dark slide. If this seems sound, and the pictures still fog, it may be owing to too much light entering the front of the lens. As far as possible the camera should be kept in the dark, or the hood of the lens must be shaded while the cap is removed, for the direct rays of the sun on the lens will produce fog.

When the plate fogs in the dark room, it may arise by *diffused light in the operating-chamber*, which gains its entrance either through chinks in the door or badly protected windows: if the space admitting light is not over two square feet, three thicknesses of the deep orange-yellow calico ought to be proof against sunshine, and two thicknesses sufficient in ordinary light. Respecting glass, the lemon yellow is useless against sunshine, and should only be used in cases where the external light is feeble. We frequently find that the ruby glass is not thoroughly to be depended on; in those cases where the sun occasionally shines on the dark-room window, a small curtain of non-actinic muslin or calico is convenient.

If you satisfy yourself that the fault does not arise from any defect in the dark room the chemicals must be out of condition, most probably the bath.

An old bath that has been some time in use gets out of order from several causes; among others, it becomes dirty and full of floating particles, with an acid or alkaline reaction from using a Collodion that has affected it—spotty from an excess of Iodide—or giving a marbled appearance,

which arises from a scum formed on the surface after standing a few days. In addition to the fair deterioration to which the Bath Solution is liable, it occasionally becomes injured from causes that are little suspected at the time; such as the introduction of a dirty glass, or one imperfectly cleaned, with the acid-cleaning solution hanging about the edges, or when an oxyd forms in scales on the sides of the vessel, which occasionally fall off into the solution.

Alkalinity is a certain cause of fog; therefore the first test is this—Immerse in the solution a piece of litmus paper, which should gradually change in colour from blue to pink: if that is not the case, add carefully a few drops of Nitric Acid until the desired effect is produced.

To obtain brilliant Glass Positives it is essential that the bath be freely acid; but for Negatives a slight trace only is required.

The remedy for a bath which is too acid is to add a small quantity of pure Carbonate of Soda—dissolve, say two drachms of soda in two ounces of distilled water.

Put the silver solution into a clean white glass bottle, and add a few drops of soda; a precipitate is immediately formed, which on shaking the bottle is at once redissolved; a second drop is then added, and so on drop by drop until the precipitate no longer redissolves, when it must be filtered and again tested with the litmus paper, and will be found rather alkaline: a drop or two of acid will remedy this, and the bath is ready for use; but after it has been corrected it is advisable to allow a day's rest before working.

When a bath has been fairly used and not tampered with, it seldom requires any special attention, and works clean and well until it becomes saturated with ether and organic matter; the excess of ether may be generally detected by the smell, in which case the best plan is to *sun the bath*, that is, to pour the solution into a shallow pan, neutralize it with Carbonate of Soda, and expose to the air and light for a few days, when the impurities become discoloured and fall in a black precipitate, which is readily filtered out: now test with litmus paper, and make it sufficiently acid to work properly.

Boiling down an old bath is an excellent remedy; a large porcelain evaporating dish, fitted over a small gas flame, is all the apparatus required: the organic matter, Ether and Alcohol, are decomposed or driven off, and after the solution has been filtered and made up to its normal strength, as shown by the bath tester, it seldom requires further attention.

A deficiency of Acetic Acid in the developer is a cause of fog; and as many samples are weak, a larger proportion than is mentioned in the formula must be employed: in warm weather, when the developer is very energetic, increase of Acid is desirable.

Pernanganate of Potash has been much recommended to destroy the organic matter instead of sunning—a weak solution, say eight grains

of pure crystal permanganate to the ounce of water, is of an intensely red colour, and a few drops added to a disordered bath will almost immediately be discoloured; the solution should be added until the bath assumes a slight rose tint. The bath is now filtered, and when only a small quantity of permanganate has been used, it generally works well without further attention, but a large dose of permanganate renders it alkaline, and a few drops of nitric acid must be added.

In all cases where alkalinity of the bath is suspected it is better to acidify after testing with a sensitive plate, developed, &c., in the dark room, and fresh acid added to the bath after each trial until the fog disappears.

Excess or Deficiency of Intensity or Contrast.—A Positive picture properly exposed presents beautiful gradations of tone. Hold it up and look through it at the sky; you will perceive that the deep shadows (that is, the dark parts of the dress) are nearly, if not quite transparent; the folds in the drapery are shown by a slight deposit of silver, while the face, hands, and white drapery, have considerably more opacity: but if the picture is laid on a piece of black velvet, the apparently opaque, or black portions of the picture, show a clear and beautiful white, from reflection of the deposited silver; while the transparent portions of the plate allow the black colour of the velvet to show through. If the plate has been over-exposed, there is a general deposit over the whole of the picture. The lights are pale and misty, and the dark parts have a yellowish-brown tone: should this not be caused by over-exposure it may be produced by fogging.

Under-exposure of the plate, on the other hand, fails to bring sufficient depth to the shadows, and nothing is visible except the strong lights, such as the face and hands; the portrait, moreover, has a sombre, gloomy appearance.

Development.—If the progress of the developer is stopped before the detail is brought out the picture will be hard, and with an excess of contrast similar to one under-exposed; while over-development causes the shadows to fog: therefore watch its progress with care; and when, by looking through the picture, the minute detail is seen, stop at once with a flood of water.

Should there be too much Acid in the Developer, the half-tones of the pictures, such as the detail in the darker portions of the coat, will be difficult to obtain.

A good Negative, when held up to the light and viewed as a transparency, ought to commence with bare glass in some few points, to represent the deep shadows with a regular gradation of deposit until we reach the strong lights, which are almost opaque.

Now, between the perfect transparency of the shadows and the

opacity of the high lights there are many gradations, which come under the general term *half-tone*. If the plate has been over-exposed the picture starts out immediately the Developer is poured on, and long before the detail is obtained there is a general fog, and the deep shadows do not present that clearness which is indispensable.

If the plate has not been sufficiently exposed the picture is tardy in making itself visible; and develope as long as you will, nothing else can be seen except those more prominent portions of the sitter which happen to have great illumination.

Unless the picture come out freely, with the Iron Solution appearing to have vigour, and possessing fair detail, it is useless to commence the re-development; but, assuming the picture looks well when the Iron has been washed off, it will intensify properly with the Pyrogallie Solution. This, to some extent, is affected by the temperature; but Acetic and Citric Acids are restraining acids, and their presence can be modified to produce any result.

It sometimes happens that the image will not intensify under the action of the Pyrogallie Acid and Silver: there are several causes, the principal being over-exposure in the Camera, excess of acid in the nitrate bath, bad light, cold weather, or deficiency of nitrate of silver in the re-developer.

For further information on Developers, see special chapter.

Streaks and Stains are generally observed whilst developing. To attempt to describe all that make their appearance would be endless; but those most frequently met with are readily distinguished and avoided: they often arise from the wet and sloppy state careless operators keep the dark slide of their Cameras in. New wood, unless well varnished, is almost sure to cause a deep stain on the corners of the plate next the carrier. In the best Cameras the corners are furnished with silver wire, and the wood (mahogany) is varnished. The remedy for this annoyance is, to wipe the drainings of the plate-holder each time it is used; and if common Cameras are employed with bone, gutta percha, or wood corners, give them a good coat of shellac varnish.

When coating with Collodion, it should be borne in mind that the object is to obtain an even film. The general fault of beginners is to hurry this part of the operation, thinking it essential to prevent evaporation. Should the Collodion become too thick towards the end of the bottle, it is readily thinned by the addition of a little Ether.

The Collodion, especially in coating large glasses, must be poured on to the extreme end of the plate, and allowed to flow in one continuous wave towards the end it is held by, or there will be a double thickness or band in the film across the plate.

If the plate is immersed into the bath too soon after it has been

coated with Collodion, a number of lines, like streaks of muddy water are formed: the same defect will arise if the plate is lifted out of the bath, or before the solution has become incorporated with the film. On the other hand, if the plate is kept too long before it is immersed, the picture will be covered with a number of small wavy marks, like bad writing.

If the Developer has not been poured with a regular steady flow, there will inevitably be a line or curling mark where its progress has been arrested, somewhat resembling a crack or a hair across the film. To remedy this, add more Alcohol, which renders the admixture of the Developer and Silver on the plate more easy and certain. An excess of Alcohol spoils the tone of a Positive picture or tends to fog a Negative; it seldom is required in greater proportion than recommended in the formulæ, except when using a Silver Bath that has been in work for some time, and thus become saturated with Alcohol and Ether from collodionized plates.

A bright spot where the Developer has been poured on is often produced by learners: when the Developer is suddenly dashed on the plate, the Silver Solution is removed from the film at that spot, and there is no foundation for forming the picture.

After the plate has been removed from the bath it should be exposed and developed without loss of time; and in placing the glass in the dark slide keep it vertical, so as to prevent the moisture and drainings which will accumulate from returning over the surface, and thus causing an infinity of stains.

Always use a clean measure for the Pyrogallic Solution, and wash it out with clean water after each picture has been taken: this precaution is not necessary with the Iron Developers, as the discoloured old solution is thrown away, and not returned to the measure.

Blue stains are caused by not sufficiently washing the plate after the development, and results from Cyanide of Potassium in the Fixing Solution mixing with the Iron, and producing a deposit of Prussian Blue on the picture. If Cyanide of Potassium is used too strong it will destroy the film and eat into the picture: it also must be well removed by careful washing after it has done its work, or the image will discolour very much in drying, the whites changing to a dirty brown.

The Hypo-sulphite of Soda used for fixing also requires attention; it must be occasionally filtered, and if not removed from the plate by a copious washing, will crystallize as the film dries. The slightest trace of Soda on the cloths used in cleaning the glasses, or on the fingers, will be fatal to every picture; therefore care must be taken to guard against it in every way.

Tender or Rotten Films.—Bad Collodion is frequently the cause, but the defect may arise from immersing the plate too quickly

into the Silver Bath before the film has set; imperfectly cleansed plates or an excessive acid bath are likely to increase the evil. There is no remedy for a *rotten* film, but a structureless tender film can be retained on the glass by roughing the edges and careful manipulation. A plate which has been kept too long out of the bath will crack or split up in development.

PRINTING PROCESS.

Imperfections in paper prints arise from two sources, viz. faults of the Negative, or bad chemical manipulation; a large proportion of the failures that an amateur has to encounter arise from the Negative.

Defects in the Negative.—A thin, weak Negative yields a poor proof; this is inevitable, but it may be improved to a slight extent by using a strong silver exciting solution, and printing in the shade; or give the back of the Negative a thin coating of the non-actinic varnish: this considerably improves its printing qualities.

A harsh, under-exposed Negative, with no half-tone or detail, prints best with a weak silver solution in direct sunshine: where there is one part of the negative more opaque than usual, and it is essential to secure a print, the judicious use of a moderate magnifying lens, used as a burning-glass to concentrate the sun's rays, will be serviceable; only be careful not to hold it too long in one spot, or in the exact burning focus: but as a general rule, thin and poor, or hard under-exposed Negatives, are not worth the trouble of printing from.

Defects in the Paper.—The sheets of paper should be examined previous to exciting; frequently they contain a number of metallic spots. Rive paper is more liable to this defect than the Saxe, but it is generally supposed to give more brilliant results: there are also defects in the albumenizing that are easily discerned.

Defects in Sensitizing.—The Silver Solution must be maintained at its regular strength, a fact easily verified by the aid of an Argentometer. A weak Silver Bath gives poor and flat prints, but it is a *great mistake* to use a strong silver solution; many of the troubles that arise, and much good paper is condemned in consequence. Forty grains of silver to the ounce of water is sufficient.

White spots with clear and sharp edges are caused by air-bubbles between the paper and silver; and a marbled appearance, seen before printing, is from a scum or oxyd floating on the surface of the solution, which can easily be removed by filtration.

Sensitive papers rapidly begin to discolour by keeping, but when

it is essential to prepare them the day before they can be printed, the addition of twenty grains of Citric Acid to the ounce of Silver Solution is recommended: also, preserve the paper in a dark, cool, dry box.

Failures in Toning.—When the print is removed from the pressure-frame it contains a variety of chemical substances, that must be removed by washing in several waters, before the Toning Bath exerts its power to advantage; moreover, these nitrates of various kinds decompose the Gold Solution, and it rapidly becomes useless.

While the prints are toning, they require constant attention. If they stick or hang together, the Solution is prevented from acting evenly, and irregular red patches are the result.

The Hypo-sulphite of Soda Fixing Bath not only reduces the depth of the print, but also seems to have the property of dissolving some portion of the gold deposit, and thus altering the colour; therefore, carry the toning *slightly beyond* the point considered desirable. An over-toned picture will be of a cold, blue-black, slaty tint.

A yellow tone in the whites is frequently caused by the pictures having been unduly exposed to light whilst printing or toning, and dirty smears arise from contact with Hypo-sulphite of Soda, either in the Toning Bath, handling the paper with dirty fingers, laying it down on dirty benches, or allowing the solutions to splash into each other. The prints sometimes do not tone readily, but remain of a dull liver colour; the Toning Bath may be too alkaline, or deficient in strength: if so, a few drops of Gold Solution will generally start it off.

Imperfect Fixing.—Dark, mottled, brown, or yellow spots appearing in the body of the paper whilst washing, are due to imperfect fixing, from the Hypo Bath having become worn out, or from the prints not being thoroughly immersed.

Impure Hypo-sulphite of Soda is acid, and smells of sulphur. It is almost sure to cause the print to fade. Many operators keep a lump of chalk in the Fixing Solution, which corrects any accidental acidity. Occasionally add fresh Hypo-sulphite to the old bath; or, better still, use a new one every time.

To sum up:—The important points in Photographic Printing are,—Cleanliness, Abundance of Water, new Solution of Hypo-sulphite of Soda, and thoroughly good Negatives.

CARTE - DE - VISITE PORTRAITURE.



THE difficulties incidental to ordinary Photographic Portraiture, as far as regards Posing and arrangement of accessory furniture, &c., are materially increased in Full-length or Carte-de-Visite Portraits.

The Negative from which they are produced is generally taken on a quarter-plate glass, $4\frac{1}{4}$ by $3\frac{1}{4}$ inches; the size of the print, when trimmed, is $3\frac{3}{4}$ inches by $2\frac{1}{4}$ inches; and, mounted on cards, $4\frac{1}{4}$ inches by $2\frac{1}{2}$ inches.

The most suitable lens is that known by us as the No. 2. The size determined by me for those of my own make is 2 inches diameter and $4\frac{3}{4}$ inches focus, measured from the back lenses; with a central aperture of $1\frac{1}{4}$ inches they work with rapidity and sharpness, but require a length of room which many Photographers do not possess, namely, 18 feet between the sitter and camera; and if this space can be obtained I recommend them, employing a central stop or diaphragm of $1\frac{1}{2}$ inches aperture. When this convenience is not to be had, the quarter-plate lens, if really good, can be substituted; but it cannot be said the feet and head of a standing figure are perfectly sharp, unless a small stop is used: one with an aperture three quarters of an inch is most generally useful. With a view of meeting and partially overcoming these difficulties, I have manufactured a smaller size card lens of shorter focus (No. 1), and it is giving general satisfaction.

The Cameras are of the ordinary construction, except in those cases where a large number of copies are required: it is then usual to have a repeating back.

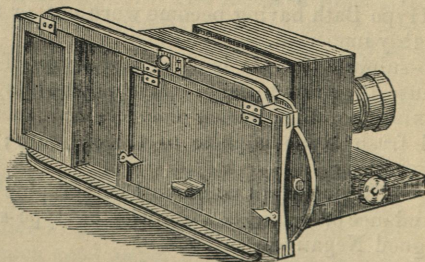


Fig. 27.

This back holds a glass, $6\frac{1}{2}$ inches long by $4\frac{1}{4}$ inches high, on which two pictures or Negatives are taken, thereby saving time in the printing operation. Binocular Cameras with two Lenses are frequently used: both Negatives are then taken at the same time, and have the same expression.

A firm Camera-stand capable of being raised or depressed, without

tilting or cocking the Camera, is requisite, similar to those shown by *fig. 17* and *fig. 18*: the effect of cocking the Camera would be to make the ground appear on an incline, giving the figure an appearance of falling forward. All upright lines, such as columns or balustrades, are affected in the same manner.

The arrangement of accessory ornaments is entirely a matter of taste. An economical plan is, to have a plain background, either painted or made of cloth, which we can now supply of a suitable neutral tint colour, without crease or seam, 8 feet by 6 feet, mounted on roller and bâton, for 26s., or plain painted backgrounds, 8 feet by 6 feet, 21s. Various descriptions of furniture can be placed in front—pictures, &c. hung against it—or wood balustrades, pedestals, or columns, may be grouped at pleasure.

In the arrangement of the figure it is necessary to consider the character of the subject. An elderly person may be taken in a sitting posture, for which a good old-fashioned easy-chair is appropriate; a young man carelessly seated on the balustrade, or leaning against a column—thus varying the position as taste dictates. When possible, there should be some occupation or signification in the position—such as reading, playing with a flower, writing, or any other trivial employment; in which case it manifestly would be out of character were not the attention directed to the supposed occupation.

In every case it is positively essential to use a head-rest, which of course must be concealed. It being difficult to disguise the large claw-foot behind a gentleman's boots, they are made with a flat, circular plate, over which the carpet can be drawn.

In trimming the pictures, lay them face upwards on a slab of glass, and cover them with a cutting-shape the size required: you then see the position the figure will occupy. It is important to remember, that the natural proportion of stature is indicated by the space left at the top and bottom of the figure; there should be at least double the space over the head than there is at the bottom.

It would be as well were the figures always taken on the same scale; a general rule is, to have the standing figure half an inch in length for every foot in height: thus a six-foot man would be 3 inches on the card; five feet six inches, 2 $\frac{3}{4}$ inches, and so in proportion.

The prints are affixed to the cards as directed at p. 30; when dry, they finally require rolling, to give a brilliancy to the surface, and as a further finish they may be rubbed with encaustic paste, which gives a depth and richness to the work.

CABINET PORTRAITS.

During the last few years a new size or description of portrait has come into use; it is a modification of the *carte de visite*, but on a larger scale, hence greater scope is obtained for the display of an artist's skill,

and a more commanding picture produced. By general consent the trimmed pictures measure $5\frac{1}{2}$ by 4 inches, which is not only larger but a better proportion than the carte de visite; the cards on which they are mounted are $6\frac{1}{2}$ by $4\frac{1}{4}$ inches. A good half-plate lens will be suitable for taking them, of course using a central diaphragm.

The negatives are taken in the same style as ordinary cartes, on glasses $6\frac{1}{2}$ by $4\frac{3}{4}$ inches, and the general remarks made on the carte portraits apply with greater force to these pictures.

STEREOSCOPIC PICTURES.



STEREOGRAM, or Stereoscopic Picture, consists of two views of the same object, taken from different points, as illustrated by the following diagram:—

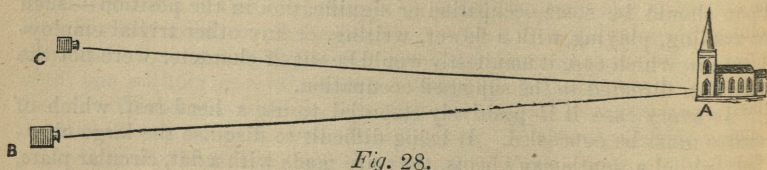


Fig. 28.

Let A represent an object to be photographed; place your Camera at a convenient distance, say in the position marked B, and obtain an impression on the sensitive plate: then remove the Camera to the left, in the position marked C; prepare a second plate and take another picture. When mounted, and viewed in the Stereoscope, they appear to stand in relief, or convey the impression of solidity.

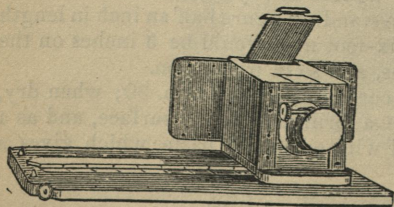


Fig. 29.

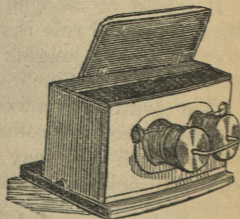


Fig. 30.

The Stereoscopic Camera is made in two forms; one, the Single Lens arrangement (*fig. 29*), is a Camera of the ordinary construction,

mounted on a board about 15 inches long and 6 inches wide: a lath is fixed on this board along which the Camera slides; the dark slide is sufficiently large to carry a glass, on which the two pictures are taken, and has a sliding groove to bring successively different portions of the plate behind the lens.

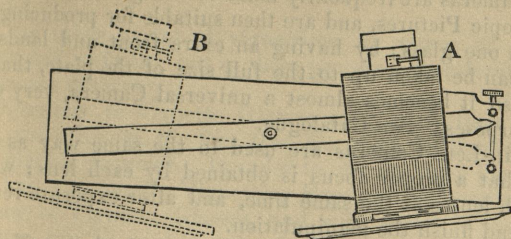


Fig. 31.

The Camera (*fig. 31*) slides along the bar, which has an angular motion, turning on a pivot in the centre of the board. When placed at the extreme right, or in the position A, the bar has an inclination to point the Camera to an object situated in the centre: when the Camera is pushed to the further extremity, a distance of ten or twelve inches, it is evident that a different subject will be depicted on the ground glass: therefore the bar is slightly turned on its axis, to bring the Camera into the position shown by the dotted lines at B, the amount of convergence being regulated by the operator at the time the focus is obtained.

To take a picture, first place the Camera in the position A, and focus the sitter, observing the position of the image on the ground glass by aid of parallel lines ruled across it. Now slide the Camera along the bar into the position B, and observe if the object comes into the same part of the field as it occupied previously; should it not do so, either the Camera has too much or too little angular motion: therefore move the bar on its centre until the desired point is obtained, and fix the stop or stud by the regulating screw.

The focus being adjusted the dark slide containing the sensitized plate is placed in the Camera, with the sliding-frame pushed to its extreme left, the Camera remaining in its position at B. Raise the shutter, and after the proper exposure replace the cap of the lens, and slip the Camera along the bar into the position it previously occupied at A. Then slide the plate-holder along the groove at the back, to bring that portion of the collodionized glass which is to receive the impression behind the lens. Again remove the cap from the lens, and when the second picture has been exposed proceed to the operating-room and develop the plate.

The Twin-Lens Camera (*fig. 30*) is more generally used. The

lenses are fixed on the front, at a distance of about three inches from centre to centre: both pictures are taken at the same time, and obviates the chance of spoiling the work by the sitter moving before the second picture is obtained.

These Cameras are frequently made of a larger size than is required for Stereoscopic Pictures, and are then suitable for producing two carte negatives on one glass; by having an extra front and landscape lens, views, &c. can be taken up to the full size of the plate, that is, $7\frac{1}{4}$ by $4\frac{1}{2}$ inches: so it becomes almost a universal Camera, very convenient for many purposes. See Catalogue.


The Twin-Lens Cameras are used in the same way as any other, observing that a proper focus is obtained by each lens; when ready uncover both lenses at the same time, and after exposure return to the dark room and finish the manipulation.

Stereoscopic negatives are usually taken on glasses $6\frac{3}{4}$ by $3\frac{1}{4}$, and the paper prints cut to the size of about $2\frac{3}{4}$ or 3 inches square. In mounting the pictures taken by a binocular camera they must be transposed, that is to say, the print from the left-hand picture of the negative must be put to the right-hand end of the card-mount, else a remarkable pseudoscopic effect is produced, the distant objects appearing in front of those in the foreground.

With a Single-Lens Camera on a sliding bar the pictures are not transposed, that object is effected by the arrangement of the apparatus.

For landscape work a portable form of Camera and the dry-plate process is usually employed, the size of the apparatus being convenient for tourists.

VIGNETTE PRINTING.

APER VIGNETTES.—This method of printing, by which the edges of the picture are gradually softened away, produces very pleasing effects, and may often be resorted to with advantage when the marginal portion of a Negative is stained, or otherwise imperfect. The plan usually adopted is to make use of a Vignetting Glass; this is a plate of glass having its centre transparent, but yellow, or chemically opaque, at the edges.

The Negative and paper are placed in the printing-frame and the Vignette Glass adjusted in front of the Negative, in such a position that the light passing through the uncoloured part of the glass shall fall upon the centre of the picture: the chemical rays being thus prevented from reaching the margin of the Negative, act only upon the central portion of the paper, and being more and more diffused towards the edges, the peculiar 'halo-like' effect is the result. The Vignette

Glass should be placed in contact with the upper side of the Negative, and care must be taken that no light enters under the edges of the Vignette Glass; this may easily be prevented by attaching strips of black paper round it. Vignettes should be printed in diffused light, and not in direct sunshine; and the frame placed at right angles to the rays of light.

There are other modes of vignetting, by means of cotton wool, tissue paper, and so forth; but in these processes considerable dexterity and practice are necessary.

The objections to Vignette Glasses are: first, their liability to breakage; and secondly, the fact that for every different-sized picture a separate glass is required. In order to obviate these inconveniences, F. J. Cox has introduced a Vignetting Frame, which entirely dispenses with the use of Vignette Glasses, and with which Vignettes of any size or shape can be readily printed. The price of the $\frac{1}{4}$ -plate size is 2s. 6d., the 5 by 4, 3s., and $\frac{1}{2}$ -plate 3s. 6d.

When using these frames the pictures can be printed in the direct light of the sun.

Vignetting Glass Positives.—The Positive Vignette Glass is the reverse of that just described, being opaque in the centre and transparent round the edges. When a Glass Positive has been taken from the Camera, but not developed, this glass is laid over it, and the whole exposed to diffused daylight; by which means the margin of the picture is solarized, while the central portion is protected by the yellow colour of the glass: therefore, on applying the Developing Solution, the solarized portions of the plate are left white, and the centre of the subject is merely produced.

After exposure, return to the operating-room and insert a Vignette Glass into the dark slide; now open the door of the room and allow diffused light to fall for a second or two on the plate; then close the door and develop the picture. A few trials will show the necessary amount of solarization which it is desirable to give. If carried too far, fogging proceeds all over the plate; and if not sufficiently exposed to the light, the vignette effect is not produced at all.

Double Printing and Tinting Backgrounds.—It frequently happens that a Negative, although good in other respects, is faulty in the background; it may be too light, or too dark, or otherwise unsuitable: in such a case, the process of Double Printing may be had recourse to. By double printing we mean, that a portion of the Negative is masked or covered whilst the other part is printed: it admits of so many varieties that it is almost difficult to offer an explanation, although the operations are very simple. For our first example we will suppose that you have a portrait negative with a weak or poor

background. You will therefore stop out the background on the negative, either with black varnish, or, still better, by a paper mask;* it is then evident that a print from this will have a plain white background: if that is not considered desirable we can produce what effect we please by double printing, for which purpose prepare a second mask, by fixing a paper corresponding with the parts already printed to the underside of a plate of plain glass; this being carefully adjusted over the print, so as to fall exactly over the right part, protecting the portion already printed, the picture is again exposed to light, and the uncovered margin printed to any depth. Very agreeable effects are produced with vignettes by lightly tinting the paper in this manner, which is rendered easy by the use of F. J. Cox's Double-printing Frame, made expressly for this purpose.

A style of vignette printing has become very popular, to which the name of 'Cameo pictures' has been given, wherein the figures stand in bold relief from a darkish background, and the edges printed in to a deeper shade.

Cameo Pictures are produced thus:—The head and shoulders of the figure are taken a full fair size, on a medium-toned background, and an ordinary vignette printed; two paper masks are required, one with an oval opening 3 by $2\frac{1}{8}$ inches, the other a simple oval paper disk the same size: that is to say, the one exactly fits into the other. When printing the vignette, the disk with the central aperture is fastened over the vignette glass; this insures a clean edge and prevents all chance of printing through. When the vignette is finished the centre is covered with the paper disk, and exposed to light until the margin is printed sufficiently deep: after they are mounted it is usual to pass them under a press and die, producing a convex surface. A simple but efficient iron screw press costs twenty shillings.

ENAMELLING PAPER PRINTS.



PHOTOGRAPHS on paper are enamelled by coating the surface with a highly-glazed film of some transparent material, by which it is protected from the action of air and moisture, and its appearance considerably improved, the detail of the print being brought out with great brilliancy. Various substances

* 'Masking.' The simplest plan of making a mask is to take a print from the Negative, cutting away those parts that are not to be stopped, and then attaching the remainder to the varnished side of the Negative, taking care that it shall exactly cover the part to which it corresponds. On printing with a Negative thus prepared, all the parts stopped out, or 'masked,' as it is called, will be left white on the paper, which is then ready for the second printing.

may be used, such as varnish, gelatine, or collodion; but the latter is preferable, on account of its affording a film which is flexible, colourless, and easily applied. The Collodion must be plain (*i. e.* uniodized), and of such a nature as to give a tough film.*

A plate of glass, free from scratches, is thoroughly cleaned and coated with Collodion in the usual way; it must then be set aside until the film becomes perfectly dry: the print is then coated freely with a solution of Gum Arabic, and, while wet, laid, face downwards, on the Collodion film, a piece of clean paper being placed over the back of the print and well rubbed down until all air-bubbles are pressed out. After being allowed to dry spontaneously, a sharp knife should be run round the edge of the print, which can then be removed from the glass, bringing with it the Collodion film, which is firmly attached to the print, giving it a surface equal to glass.

OPALOTYPE.

THIS is a method of producing Photographs on Opal Glass. The manipulation is simple, and only requires care and cleanliness. The sensitizing agent is Collodio-Chloride of Silver, it can be purchased ready prepared for use. The Opal Glass Plate must be carefully cleaned, and then painted with a border of India-rubber Varnish, about an eighth of an inch wide, around the margin and over the edge, to hold the film, and prevent it being washed off the glass in the subsequent operations. The plate is coated in the dark room with the Collodio-Chloride, in the same manner as ordinary Collodion. It must next be *quickly* dried, and when cold is ready for printing. The Printing-Frame is differently constructed to the one used for paper prints. (See *fig. 32.*) The Negative is placed in the open part of the frame, and kept in position by the spring-bar, whilst the Opal Glass is in the lower portion, and pressed into contact with the Negative by springs at the back. It is evident, that when the frame is opened to examine the Opalotype the glass would be thrown out of its position, were it not for the clamping-screw in front. Directions for use of this frame are sent with each.

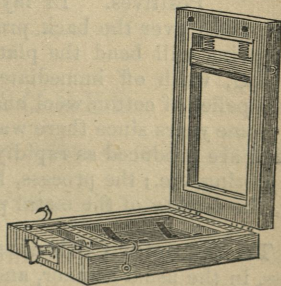


Fig. 32.

* Frederick J. Cox's Enamel Collodion, prepared for this process, may be had in small bottles, at 9d. each.

The picture must be printed deeper than usual, as it is much reduced in toning, and when removed from the frame washed by a stream of water, and then immersed in the toning solution; when toned again washed, and fixed by a solution of Hypo-sulphite of Soda, in the proportions of 1 ounce of hypo to 5 of water, for five minutes, after which it is washed, dried quickly, and varnished in the ordinary way.

Precautions.—The operations of coating, toning, washing, &c., must be performed in the dark room, or by artificial light. The toning bath must be *old*, and very dilute; the following formula is suitable:

Acetate of Soda	20 grains.
Chloride of Gold	1 grain.
Water	20 ounces.

The toning should not be carried too far, as the pictures darken in drying.

The Negatives used in this process are taken upon plate glass, to ensure perfect contact.

PORTRAITS ON METAL PLATES AND TRANSFER CLOTH.

PORTRAITS are taken on metal plates when required for mounting in brooches, locketts, or rings. They are coated with Collodion, excited, and developed the same as Glass Positives. In laying the plate in the dark slide, place a plain glass over the back previous to closing the door, or the force of the spring will bend the plate. Should the picture not appear worth keeping, wash off immediately, and the plate may be cleaned with a small pellet of cotton wool and alcohol.

Some years since there was a considerable demand for these pictures, which are produced as rapidly as positives on glass, and are convenient for posting, &c.; the process, however, fell into disuse, but is again reviving, the quality of the metal plates having been considerably improved.

To Transfer Collodion Positives.—You first take a picture on glass, in the usual manner, and cover the surface with Alcohol, to which a few drops of Nitric Acid have been added (say, three drops of acid to the ounce of spirit), and while still wet, lay the transfer-cloth gently over this, pressing it into close contact, and excluding the superfluous moisture and air-bubbles: let it remain in this state for two or three hours, or until dry, when it may be lifted off the glass, bringing the film with it.

COLOURING PHOTOGRAPHS.*

POSITIVES on glass are tinted by means of dry powder colour. About three sizes of brushes will be required, made either of Camels' Hair, Goats' Hair, or Sable; they are, previous to commencing, pointed, by just dipping them in a vessel of water, and shaking or rolling them between the hands, so giving them a very fine point. When they are perfectly dry apply the colour, by working it on the Collodion with a light circular motion. When the colour has been well worked in, blow off the excess by the India-rubber bellows, and then varnish the picture; and if necessary, more colour can be afterwards applied.

Gold chains, rings, &c., are touched with a little gilt obtained from a gold shell, by wetting the brush.

Flowers, fine buttons, or any very small articles, may be touched with water-colour.

For Paper Pictures ordinary water-colours in cakes are used.

The picture should be taken on Salted Paper in preference to Albumenized, and mounted on a stiff cardboard; when dry, the surface will require preparation previous to applying the colours: this is often done by means of Parchment Size, but Newman's Preparation for Sizing is superior.

Photographs taken on Albumenized Paper can be coloured with water-colours, by first washing the paper with the same preparation, which remedies the greasy nature of the surface.

COPYING PICTURES.

CONSIDERABLE misapprehension exists as to the practical details for copying Photographs.

To render the subject more intelligible, we will divide it into three parts.

FIRST.—Copying from a Paper Photograph, Engraving, Painting, or Manuscript.

SECOND.—Reproduction or enlargement of Negatives, and a method of making Transparencies for Magic Lantern pictures by the wet process.

THIRD.—Enlargement on paper from a small Negative.

* It is impossible to enter into full details of the art of colouring. Newman's 'Harmonious Colouring, as applied to Photographs,' is the best work on the subject. Frederick J. Cox can supply copies, post free, on receipt of 14 stamps.

These comprise the principal requirements of the photographer, and each is effected in a different manner.

Copying Engravings, Prints, &c.—Lenses of various kinds are employed for copying; for ordinary work, where a slight distortion of the marginal lines is unimportant, the ordinary single achromatic may be used, but generally the portrait combination with a small stop is most convenient.

The size of the copy is regulated by the distance at which the Camera is placed from the object, and the focus of the lens considerably lengthens as the object to which it is directed is brought nearer to it. To obtain a copy the size of the original with an ordinary quarter-plate lens, of say 6-inch equivalent focus, the Camera would be extended to about 12 inches, and the engraving to be copied placed the same distance in front of the lens.

When an enlarged copy is required the object is placed closer to the lens, and the length of the Camera at the same time increased; where reductions are wanted, the reverse proportions are required.

In copying Photographs or Engravings, they should be fixed against a *dark* wall or background, and fastened perfectly vertical at a convenient height from the ground; then place the Camera in front of the picture, and obtain the focus *by sliding the expanding body of the Camera* until the proper degree of sharpness is obtained. Should the image not be large enough, take the Camera closer to your copy; if too large, of course it must be moved further away. When this is settled, sensitize the plate in the same manner as for an ordinary picture.

It is advisable to use, for copying purposes, a Collodion that has been iodized for some time, and allowing a proportionate length of exposure.

Should the original copy be covered with a glass, it must be removed, or there may be reflection of diffused light into the lens.

An ordinary Portrait Lens, with central diaphragms, is very suitable, but obtain the focus with a medium-sized stop, and use a proper focussing glass, else it is almost impossible to produce a sharp picture; then insert a diaphragm of the size you intend to work with.

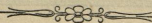
When the reproduction is required nearly or about the same size as the original, difficulties arise, principally from the rough magnified fibre of the paper, which becomes very objectionable; and for this reason enlargements from paper prints can only be secured by taking a small negative, and then enlarging *that* by the means hereafter described.

There are cases where there is no choice but to produce the best copy we can from a bad original; such as a rough, stained, or yellow print: these difficulties may be modified to some extent by rolling,

damping, or pressing, touching up with powder-colour the worst spots, or strengthening faint lines. When copying from a coarse or rough-surface paper, it can sometimes be modified by casting a reflected light from the opposite side by a sheet of white paper; with oil-paintings it is difficult to avoid the gloss, for this reason they are often inclined forward and the Camera pointed upwards to meet them.

Reproduction of Negatives.—A large number of copies are sometimes required in a short period of time, and a ready means of multiplying a Negative is desirable. The simplest plan is to prepare a dry plate by any of the well-known processes. Place the Negative and dry plate in contact in an ordinary pressure-frame, and expose in diffused daylight for a few seconds; then develop the plate, and a transparent Positive will be produced. Fix and varnish it; then print from it again on another dry plate, which produces a Negative. The Positive can be used an indefinite number of times, and the results are scarcely inferior to the original Negatives.

The Liverpool Dry Plates are very satisfactory, and can be procured ready for exposure. See Catalogue. Directions for developing and fixing accompany every package.



TRANSPARENCIES FOR THE MAGIC LANTERN.

THE Transparent Positive described above, after it has been used for the reproduction of Negative copies, is of itself useful for exhibition in the Magic Lantern: but there is another method by which they can be produced within the reach of every photographer who can prepare the Negative, and that is to print them on *wet* Collodion plates. The plan recommended is this,—Procure a square wooden tube, say 5 inches square and 3 feet long; have some arrangement at one end by which the ordinary camera-back may be fixed; when the sensitive plate is prepared, place it against the Negative, just separated by a thin slip of card at each end to prevent actual contact with the wet film and the negative—this slight separation will to some extent impair the sharpness of the copy, hence the use of the long wooden tube. When the plates are so far in contact put them, negative downwards, into the ordinary camera dark slide, and affix it to the end of the wooden tube, one end of which is directed to the open sky.

The purpose is this,—owing to the slight space between the negative and the sensitive plate the lines will be doubled or blurred from the side-light shooting between the glasses, but by fixing the long tube in front none but parallel rays pass the Negative.

The open end of the tube is best covered with a piece of fine ground glass or oiled tissue paper to soften and modify the light; when all is ready withdraw the sliding shutter and expose for a few seconds, return to the dark room and develope.

Enlargement of Negatives.—The process of enlarging Negatives is very simple. A Camera is required that is capable of great extension of focus, and with an arrangement to hold the lens in its centre; similar to

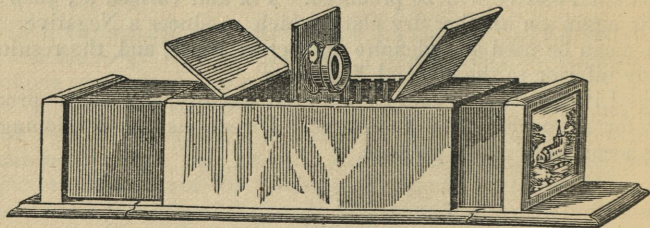


Fig. 33.

From an examination of which it will be seen that the negative to be enlarged is fixed at one end of the Camera, the lens is placed about the centre, and the sensitive plate at the extreme far end; the exact distances depend on the focus of the lens and the amount of enlargement required, and must in all cases be a matter of special arrangement, for which purpose the Camera has a sliding or leather bellows body at both ends.

We will assume that a quarter-plate Negative is to be enlarged. The ordinary carte portrait lens, with a small central stop, is placed in the centre compartment, and at one extremity of the Camera the Negative to be copied is fixed, in such a manner that no light can reach the lens except that which has passed through the Negative; the other end of the Camera carries the dark slide containing a prepared sensitive plate.

The Camera is turned up towards the northern sky, and the image focussed sharp; an ordinary wet Collodion plate is then exposed, and the resulting picture is a transparent Positive: this should be made as near as possible the same size as the original Negative, and taken cleanly, without stains or spots. It must be full of detail, exceptionally free from fog, and not too dense; therefore carefully avoid over-intensifying it.

At this point carefully examine the picture, and if marked by small spots, or in any way capable of improvement by retouching, this is the time to do it: then proceed to make the enlarged Negative. Place the Positive in the carrier at the end of the Camera, and repeat the operation; this time the result will be a Negative, and enlarged according to the distance between the lens and the Positive copy.

From this enlarged Negative proofs are printed on paper in the usual manner.

Enlargement up to Life Size on Paper.—The plan just described for making enlarged Negatives is not satisfactory when pictures more than 12×10 inches are required; but they can be made of any size by an arrangement similar in principle to the Magic Lantern. When artificial light is employed we recommend the Lime Light; and a special apparatus, costing about 12*l.*, is required: the method of using it is very simple; it may suffice to say that the picture is thrown on the wall, against which a sheet of excited paper is fixed.

To avoid the use of artificial light a Solar Camera is required; this acts on the same principle, but absolute sunshine is necessary.

The pictures are produced on sensitive papers by the process known as 'Printing by Development,' for the ordinary albumenized paper is not sufficiently sensitive.



PRINTING BY DEVELOPMENT.



PRINTING by Development is generally adopted where the light is feeble, in order to reduce the time of exposure.

The paper most suitable is 'Saxe.'

SALTING SOLUTION—Iodide of Potassium	60 grains.
Chloride of Potassium	40 grains.
Distilled Water	4 ounces.

and a small quantity of Citric Acid, just sufficient to colour litmus paper.

The paper may be floated on this for a minute or two, or laid on a flat board, and the surface coated with a brush.

EXCITING SOLUTION—Distilled Water	1 ounce.
Nitrate of Silver	1 drachm.
Glacial Acetic Acid	10 to 12 drops.

The papers are either floated or brushed, and whilst wet exposed

until there is the faintest trace of the picture visible, then developed with a saturated solution of Gallic Acid. The method of development is to lay the picture face upwards on a flat board, turning up the edges of the paper all round, so as to convert it into a tray; then pour the developer on the picture, and spread it about with a glass rod bent in the form of a triangle. When sufficiently intense, throw off the Gallic Acid and pour on a good supply of water, after which fix with Hypo-sulphite of Soda as usual. With a little care the paper can be made to hold up at the edges so as to avoid the necessity of large dishes.

Rapid Iron Developer.—The paper is iodized thus,—

Water	5 ounces.
Gelatine	40 grains.
Chloride of Sodium	40 grains.
Iodide of Potassium	2 drachms.
Bromide of Potassium	100 grains.
Ammonia	5 drops.

Filter and float the paper whilst the solution is warm.

Exciting Solution.—Silver, 50 grains to an ounce of water.

Developer.—Nothing better than the common Iron Developer for Negatives (*see* page 22) diluted with twice its bulk of water. The manipulation is as above described, and the time of exposure for an enlargement of the full-size paper from a quarter-plate Negative by the oxy-hydrogen light, is from 1 to 2 minutes.

INTENSIFYING.

It is very rarely that Negatives acquire sufficient intensity for vigorous prints with the Iron Developer; therefore, at page 22, instructions are given for increasing the density of the film. Another formula, which with some samples of Collodion is preferable, contains Iron instead of Pyrogallie Acid: in some instances a few drops of Silver Solution added to the Iron Developer are sufficient, at other times a more energetic power is needed. Take the ordinary Iron Developer, page 22, and mix with it an equal quantity of Citrate of Silver.

Nitrate of Silver	1 drachm.
Citric Acid	90 grains.
Alcohol	1 drachm.
Water	4 ounces.

It may sometimes occur that the intensifier does not readily mix with the small portion of original developing solution on the plate. This can be remedied by a few additional drops of alcohol. Should the inten-

sifier become turbid it must at once be thrown away, and a fresh solution poured on, or a grey precipitate will be formed.

The place where the solution is poured has a tendency to become rather deeper; but it must be borne in mind that no accession of detail is gained by the intensifier, simply a greater depth or contrast: it is, therefore, useless to waste time over an under-exposed Negative.

It occasionally is necessary to strengthen a Negative after it has been fixed and dried; the following will be generally successful:—

Dissolve a grain of Iodine in a few drops of Alcohol, then add an ounce of water.

Pour this over the picture; allow it to remain about half a minute, then wash with water; now expose to diffused daylight for half a minute, and intensify with the Pyrogallic Acid and Silver (page 24).

It sometimes happens that a Negative is weakened in varnishing, and it becomes necessary to deepen the deposit: in such cases the varnish creates a difficulty, which can, however, to some extent, be obviated. Cover the varnished surface with strong Alcohol; this slightly softens the film: then flood it with a weak solution of Iodine in Alcohol, about the colour of sherry. The plate soon intensifies, and becomes of an olive-green colour, which is very non-actinic. Quickly wash the film with alcohol, and afterwards with water: when dry, it can be revarnished if necessary.

Whilst intensifying it is frequently necessary to add a few additional drops of Silver Solution, and a convenient means of doing this is by the Pneumatic Dropping Bottle (*fig. 34*). It consists of an ordinary bottle with a long hollow stopper reaching nearly to the bottom of the bottle; at the upper end it is blown out into a bulb and covered with India-rubber. On applying the slightest pressure of the finger the air is expelled, and on releasing the pressure the liquid rushes up into the hollow stopper; it is then removed from the bottle, and, by reproducing the pressure, either single drops or more are procured with certainty. The cost of this simple though useful article is two shillings. The same article is most suitable for acids, or any purpose where small quantities of liquid are required.

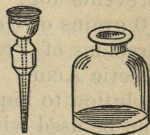
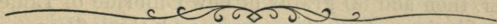


Fig. 34.



DEVELOPERS FOR NEGATIVES.



GREAT latitude is practicable in the strength of Iron Developers; as a general rule, from 15 to 20 grains of iron to the ounce of water are best. A weak solution develops slowly, requires more acid to keep the shadows clean, and produces a hard picture.

The double Sulphate of Iron and Ammonia is recommended for its keeping qualities.

Sulphate of Iron and Ammonia.....	6 drachms.
Glacial Acetic Acid	$\frac{1}{2}$ an ounce.
Water	10 ounces.
Alcohol	about 2 drachms.

Saccharo-sulphate of Iron Developers are useful in warm weather, and give great density at times when ordinary iron developers are working poor.

Proto-sulphate of Iron.....	40 grains.
Lump Sugar.....	12 grains.
Glacial Acetic Acid.....	20 drops.
Water.....	2 ounces.

Organic Developers are those which contain some organic matter, such as gelatine, which appears to act as a restraining agent, and prevents fog. A very good developer is simply made by dissolving 10 grains of Gelatine in a pint of warm water, and when cold adding 6 drachms of Proto-Sulphate of Iron, and about 3 drachms of Glacial Acetic Acid. Sulphate of Copper is sometimes added to the Developing Solution to improve its keeping qualities; from 5 to 8 grains per ounce can be used with any of the Iron Developers.

TONING SOLUTIONS.


In addition to the Toning Solution described on page 27, either of the following are recommended. The tone of the print with each is somewhat different.

Phosphate of Soda	1 drachm.
Water	10 ounces.
Chloride of Gold.....	2 grains.

Used fresh.

Lime-Toning.—Dissolve 15 grains of Chloride of Gold in a pint of distilled water, then add 30 grains of new Chloride of Lime; shake well together several times for a few days, and then filter. It should be colourless, therefore dilute it with another pint of water, and it will keep indefinitely. If the colour of the liquid is too yellow it will bleach the prints: in that case add more lime to it and filter again.

RETOUCHING

S a term applied to a system extensively practised at the present time to enliven a Negative, by relieving the heavy shadows and violent contrasts, or to clear up the partially obscured details, by judiciously working over the film with the point of a fine black-lead pencil, a small brush and water-colour, or black-lead in powder, rubbed into the surface.

The Negative to be touched is supported on a frame or easel, termed a retouching desk; this desk is placed opposite a steady light, such as would be received from a window with a northern aspect, in such a position that the light is reflected through the Negative from a mirror or white card, a hood or screen of some kind being fixed in front, to shade, as far as possible, the eyes of the artist from any direct light.

The working materials are—the best black-lead pencils, degrees HB, B, and BB, some water-colours, fine brushes, black-lead in powder, and a paper stump used for rubbing in the lead powder.

If the Negatives have been varnished in the usual manner, the surface is too hard to take the pencil kindly, and a little prepared chalk may be worked over it by a light circular motion with the point of the finger: this gives a bite to the pencil.


There are preparations in the trade sold as retouching varnish, but, in the absence of any other, use the ordinary varnish diluted with half its bulk of alcohol.

Before commencing make a paper proof from the Negative, by which the deficiencies and those points requiring modification suggest themselves. First, it is advisable to consider which portion of the picture required the greatest force, and remembering that the part of the Negative darkened by retouching is produced light in the print, proceed to bring out the strong lights on the cheek, forehead, and, if necessary, the background, using the powder lead and paper stump.

The furrows and wrinkles may be softened by slightly working the pencil, not exactly in straight lines, but with a circular rubbing motion, as if endeavouring to force the pencil point into the film, but of course being careful not to injure the surface by abrasion; the Negative is thus gradually darkened, softening and relieving the harsher details, but not so far erasing them as to destroy the character of the original: the smallest brush, with a particle of water-colour, may be applied to the eyes and lips if desirable, and this is the best medium for stopping pin-holes in the film.

The Negative can be again varnished, if thought necessary, in the ordinary way.

THE USE OF STOPS AND DISTORTION.

HE Portrait Lens is constructed for rapidity ; and, to secure that, many other considerations are passed over. A good portrait lens gives sharp definition, without a stop, over a portion of the picture ; but it cannot be made to embrace objects at different distances, and having considerable curvature of the field there is indistinctness at the edges.

With a sitting figure it is possible to get tolerable results with an open lens ; in such cases you focus for the face of the subject, and the knees, or feet, naturally being in advance, have a longer focus, and thus accommodate themselves to a flat plate.

With standing figures nothing can be done without a stop ; this compels the rays of light to fall obliquely on the margin of the lens, which lengthens their focus, and consequently they reach a flat plate without confusion. A stop also improves the general definition, and renders the focal point finer, or more attenuated : hence, objects at different distances from the camera are sharper.

A very small stop in a portrait lens renders the field sufficiently flat for copying purposes ; the proper position is nearly in the centre of the tube, between the combination of lenses : there is then no practical distortion, which would be the case were it placed in any other position : with the same arrangement they are also suitable for views, but the picture is not so crisp as with the single achromatic.

The single achromatic lens has less curvature of the field ; but the *spherical aberration*, which is quite a different thing, is so great, that it cannot be used without a small stop placed in front of the lens. Its position affects the character of the image in two respects : first, as respects distortion ; and secondly, the quality of definition. The general rule is to place the stop about the same distance in front of the glass as the diameter of the lens ; it there exerts its influence with the greatest effect : were it further away distortion increases, and when it is closer to the glass the curvature of the field is greater. The size of the aperture determines the sharpness of the picture, both as to general focus and depth of focus ; but always use as large a stop as satisfies the requirements of your picture.

CONCLUDING HINTS.

Cleanliness is most important in successful work. Always wash every vessel immediately it is done with; do not keep bottles or dishes standing about with useless solutions; dust the dark room out a short time before commencing work.

Cleaning Dirty Bottles.—If the bottle has a deposit, arising from hard water being left in it, rinsing out with dilute hydrochloric acid will immediately dissolve off the carbonate or sulphate of lime, of which the crust consists. Stains of iron may be likewise removed by the same solvent; in this case, however, the acid must be used strong and slightly warm, as the deposit is more difficult to remove. Other impurities, such as oil or grease, require an alkali, such as washing-soda.

Other kinds of impurity require special solvents to loosen them. Methylated spirits will also be found useful, the latter especially in cleaning out bottles that have contained Collodion; black varnish is also readily dissolved by this liquid. It is, however, inadvisable in many cases to resort to *chemical* methods of cleaning until mechanical ones have been tried, such as small shot or gravel-stones; common ashes are excellent detergents.

Removal of Stains from Linen Fabric.—Make a solution of common Alcohol, 5 oz., Iodine, Nitric Acid, and Hydrochloric Acid, 1 drachm each.

These produce a reddish liquid, which, when applied to stains caused by *any salts* of silver, immediately converts them into chloride and iodide of silver, soluble in hypo-sulphite of soda.

The effect is especially marked on stained linen: when a black patch is touched with the liquid, by means of a brush, it instantly turns yellow; on washing with the hypo-sulphite the yellow spot vanishes by degrees. It is well to wash the stained place after the application of the iodized solution to remove the acids, which might produce independent stains by contact with the hypo-sulphite.

To prevent the Film slipping from the Glass.—With large plates and under certain conditions of the Collodion, it may be advisable to coat the glass with a substratum of albumen: a filtered solution, containing the white of an egg to a quart of water, is used; it also avoids marks from imperfect cleaning. On the washed plates still wet pour over the albumen, and rear on end to dry. The plates will keep several weeks, and may be preserved in plate-boxes, simply requiring to be dusted before collodionized. The albumen solution must be used fresh and not allowed to run over the back of the glass.

Film Drying.—In very hot weather, or when working some distance from the operating-room, the surface of the film is apt to become too dry; in these cases the plate may be redipped for a moment in the bath, just before development.

WEIGHTS AND MEASURES.



CHEMICALS are bought and sold by Avoirdupois weight, except some liquids, which are sold by the fluid-ounce; the chemical proportions given in this book are by Apothecaries' weight and fluid measure.

APOTHECARIES' WEIGHT.

20 grains = 1 scruple.
 60 „ = 3 „ = 1 drachm.
 480 „ = 24 „ = 8 „ = 1 oz.
 There are only $437\frac{1}{2}$ grains in the ounce avoirdupois.

FLUID MEASURE.

60 minims = 1 drachm.
 480 „ = 8 „ = 1 ounce.
 960 „ = 160 „ = 20 „ = 1 pint.

